Soneplex

FIBER LOOP CONVERTER REFERENCE GUIDE

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September 20, 2002

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USING THIS GUIDE

- Three types of messages, identified by icons, appear in text.

Notes contain information about special circumstances.

Cautions indicate the possibility of personal injury or equipment damage.

The Electrostatic Discharge (ESD) symbol indicates that a device or assembly is susceptible to damage from electrostatic discharge.

RELATED PUBLICATIONS

Copies of the following publications can be downloaded from the ADC website at www.adc.com.

Title	ADCP or SAP Number
DS3 FLC Two-Position Horizontal Mounting Shelf User Manual	61-148
DS3 FLC User Manual	61-128
FLC Eight-Position Universal Mounting Shelf User Manual	61-118
FLC Four-Position Universal Wall Mount Cabinet User Manual	61-120
Model FLC-A10MPU FLC Main Processor Unit User Manual	61-129
Quad DS1 FLC (B2/B3/D3 Versions) User Manual	61-135
Quad FLC Two-Position 19-Inch Horizontal Mounting Shelf User Manual	61-154
Quad FLC Two-Position Horizontal Mounting Shelf User Manual	61-125
E1 Quad Fiber Loop Converter User Manual	1218226

GENERAL SAFETY PRECAUTIONS

The following cautions apply throughout procedures within this guide.

Danger: To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Never assume laser power is turned off or that the fiber is disconnected at the other end.

Danger: Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid the potential of dangerous amounts of radiation exposure, a protective cap or hood MUST be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also prevents dirt particles from entering the connector.

Warning: ADC Fiber Loop Converters are designed to be used with ADC Fiber Loop Converter Chassis. When used together, the modules and chassis assemblies form a Class 1 Laser Kit which conforms to all applicable standards of 21 CFR 1040. If the modules and chassis are used in any other way, compliance to the above standard is not guaranteed.

Warning: To avoid the possibility of severe and potentially fatal electric shock, never install electrical equipment in a wet location or during a lightning storm.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazardous, invisible laser radiation.

Caution: Always allow sufficient fiber length to permit routing without severe bends. Fibers may be permanently damaged if bent or curved to a radius of less than 1.5 inches (3.81 cm).

Caution: For continued safe operation, replace all fuses with same type and rating.

Caution: All wiring external to the product(s) should follow the provisions of the current edition of the National Electrical Code.

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OVERVIEW

The Reference Guide is intended for users who are familiar with fiber-optic and digital transmission within a Central Office (CO) or Customer Premises Environment (CPE). This guide describes the products and provides the following information:

- Instructions for installing, configuring, and wiring the chassis
- Optioning, installing, and testing the module
- Operating and maintaining Fiber Loop Converter (FLC) systems

The Fiber Loop Converter family of products provide a means of furnishing multiple and DS3 or E1 service over fiber-optic cable. This guide covers FLC modules that transport QUAD FLCs (transport four DS1 or E1 signals), DS3 FLC, FLC Main Processor Unit (MPU), and their mounting chassis.

References to QFLCs imply both DS1 and E1 unless otherwise specified.

CHASSIS TYPES

Table 1 describes the T1 and E1 chassis types and applicable FLC modules.

Table 1. *T1 and E1 Chassis Types*

Chassis	Modules Held	Power Feed	Alarm Terminals		T1/E1, T3 Termination	Access	Weight (lbs.)
			Chassis	Each Slot			
Mounting Shelves							
DS1/E1 Two-Position (23-inch) DS1/E1 Two-Position (19-inch)	QFLC	-48 Vdc A & B Feeds	Major Minor	Remote Site Input	T1/E1:WW	fiber (left side); copper (right side)	17.68 (23-inch) 14.07 (19-inch)
DS3 Two-Position	DS3 FLC QFLC	-48 Vdc A & B Feeds	Major Minor	Remote Site Input	T1/E1:WW T3:WW	fiber (left side); copper (right side)	17.52
Universal FLC Eight-Position	DS3 FLC QFLC	-48 Vdc A & B Feeds	Major Minor	Remote Site Input	T1/E1:WW T3:WW	each side	33.6
Wall Mount Cabinets							
Universal FLC Four-Position	DS3 FLC QFLC	120 VAC or -48 Vdc	Major Minor	Site Input	T1/E1: WW T3:WW	top and bottom	32.85

FOUR-POSITION UNIVERSAL WALL MOUNT CABINET

- Model FWM-WWA04A—16.8 H × 15.9 W × 9.6 D inch wire-wrap terminations. Two DC power supplies included in cabinet.
- Model FWM-WWD04A, FWM-WWD04B—Same dimensions as above. Wire-wrap terminations. Powered by an Argus wall-mounted battery backup power unit.
- Model FWM-WWX04A—Same dimensions as above. Wire-wrap terminations. No power supply.

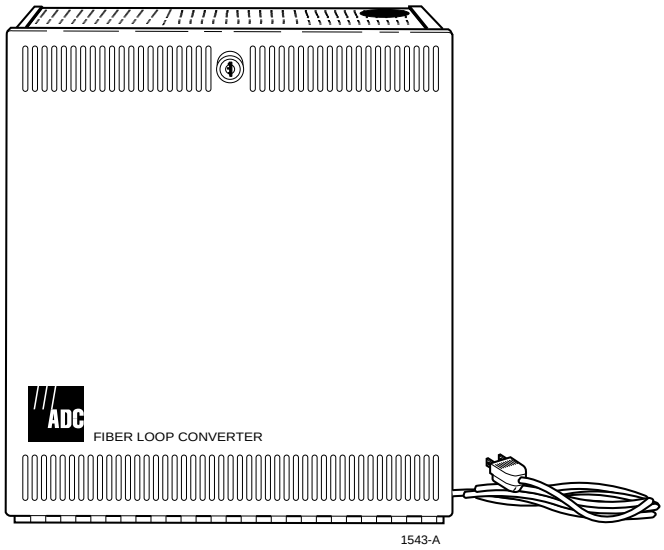


Figure 1. *Four-Position Universal Wall Mount Cabinet*

CHASSIS INSTALLATION

1. Choose a mounting location to allow a minimum of 8 inches on each side of the cabinet to open the side panels.
2. Using the template furnished, mark the four key holes on the wall base.
3. Drill $^{5}/_{32}$-inch holes and place the four furnished screws $^{1}/_{4}$-inch out.
4. Install the cabinet and secure the four screws.

DS1/E1 LINES—WIRE WRAP

Connect the lines and shield ground to the wire-wrap terminal (see Table 2). Use 22 or 24 AWG twisted pair shielded wire.

Table 2. *Wire-Wrap Connections*

T1/E1 Line Number	Wire-Wrap Pin			Mounting Position DS1/E1 QFLC	
				Protect	Unprotect
	EQ In (to FLC)				
1	1	T	R	1 & 2	1
2	2	T	R	1 & 2	1
3	3	T	R	1 & 2	1
4	4	T	R	1 & 2	1
1	5	T	R	3 & 4	3
2	6	T	R	3 & 4	3
3	7	T	R	3 & 4	3
4	8	T	R	3 & 4	3
	EQ Out (from FLC)				
1	1	T	R	1 & 2	1
2	2	T	R	1 & 2	1
3	3	T	R	1 & 2	1
4	4	T	R	1 & 2	1
1	5	T	R	3 & 4	3
2	6	T	R	3 & 4	3
3	7	T	R	3 & 4	3
4	8	T	R	3 & 4	3

DS3 LINE INTERFACE ACCESS

DS3 FLCs used in the Four-Position Universal Wall Mount Cabinet require the DS3 adapter kit (catalog number FWM-DS3KIT-4). Coaxial cable and PC board assembly connect the DS3 input and output signals to the cabinet backplane. Mounting and installation instructions are included with each kit (see Figure 2 on page 5).

If DS3 FLCs share the chassis with Quad Fiber Loop Converters (QFLCs), the DS3 FLCs should be placed to the left of the QFLCs for FCC EMI compliance.

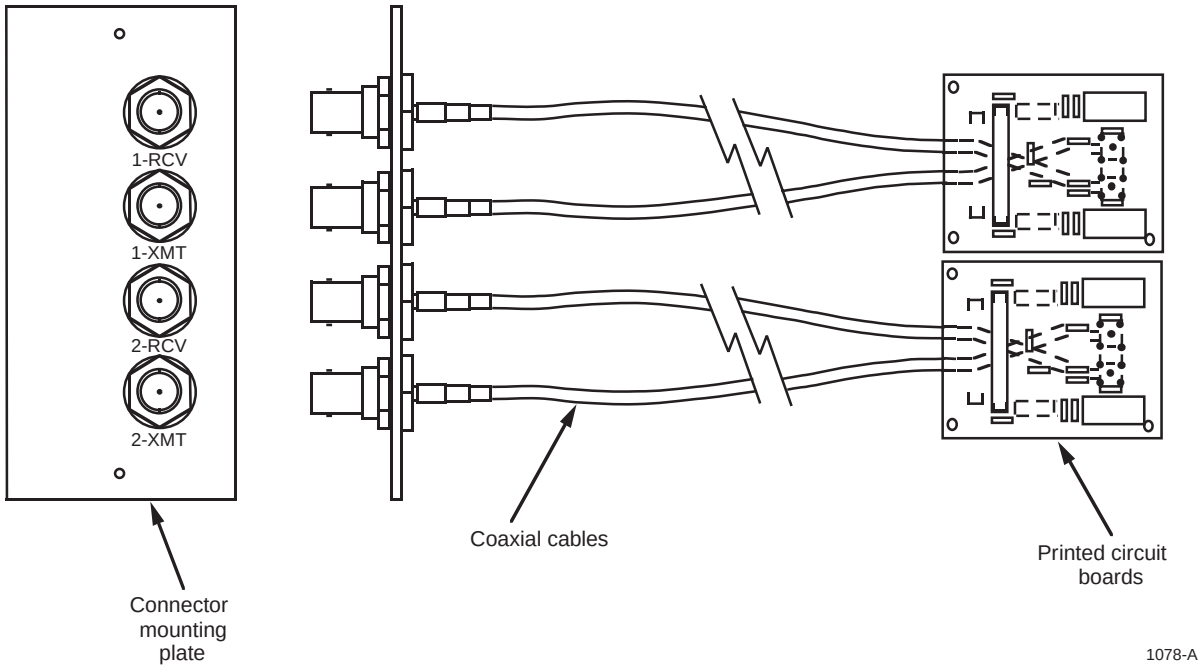


Figure 2. *Four-Position DS3 Adapter Kit*

POWER AND ALARM INSTALLATION

- On models with internal DC power supplies, apply power to the cabinet by plugging in the AC power cord that extends from the bottom of the cabinet.
- On models with the FLC-AC/BB2 battery backup power unit, route the power cable into the cabinet through the flex grommet on the bottom. Connect the cable to the J9 terminal strip located on the backplane (see Figure 3).
- Connect the Major, Minor, and Remote alarm surveillance equipment to the 15-pin D sub connector located on the right side panel (see Table 3 on page 6). Use 24 AWG wire.

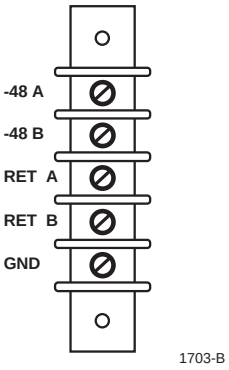


Figure 3. *-48 Vdc Power Connections*

- Connect Housekeeping alarm inputs to the 15-pin D sub connector (POS. 1 HSKP inputs to the FLC in slot 1, POS. 2 HSKP inputs to the FLC in slot 2, and so on.) A site alarm is initiated by a closed loop (short) from user equipment.

See "Appendix A - Alarm Information" on page 81.
See "Appendix C - Universal Wall Mount and Mounting Shelf Position Usage" on page 83.

Table 3. *15-Pin D Sub Female Connector – Alarm Connections*

Function	Pin Number
MAJOR ALARM NO	1
MAJOR ALARM COM	9
MINOR ALARM NO	2
MINOR ALARM COM	10
Remote alarm NO	3
Remote alarm COM	11
POS. 1 HSKP. INPUT A	4
POS. 1 HSKP. INPUT B	12
POS. 2 HSKP. INPUT A	5
POS. 2 HSKP. INPUT B	13
POS. 3 HSKP. INPUT A	6
POS. 3 HSKP. INPUT B	14
POS. 4 HSKP. INPUT A	7
POS. 4 HSKP. INPUT B	15

FIBER INSTALLATION

Danger: Do not look into the ends of any optical fiber. Exposure to invisible laser radiation may result. An optical power meter should be used to verify active fibers.

Caution: Minimum bends radius for fiber is 1.5 inches. Avoid making sharp bends in the fiber.

1 Route fiber patch cords into the cabinet through either top or bottom access holes (see Figure 4 on page 7).

2 Feed the fiber through the area over the mounting positions until they extend 10 inches beyond the front of the card cage in order to connect to the module.

3 Place the fiber in the fiber guides, if provided. Coil excess fiber around the fiber spools.
See "Appendix B - Storing Fiber on Spools" on page 82.

QFLCs or DS3 FLCs placed in odd- or even-numbered mounting positions should be optically connected to remote FLCs in odd- or even-numbered mounting positions, respectively.

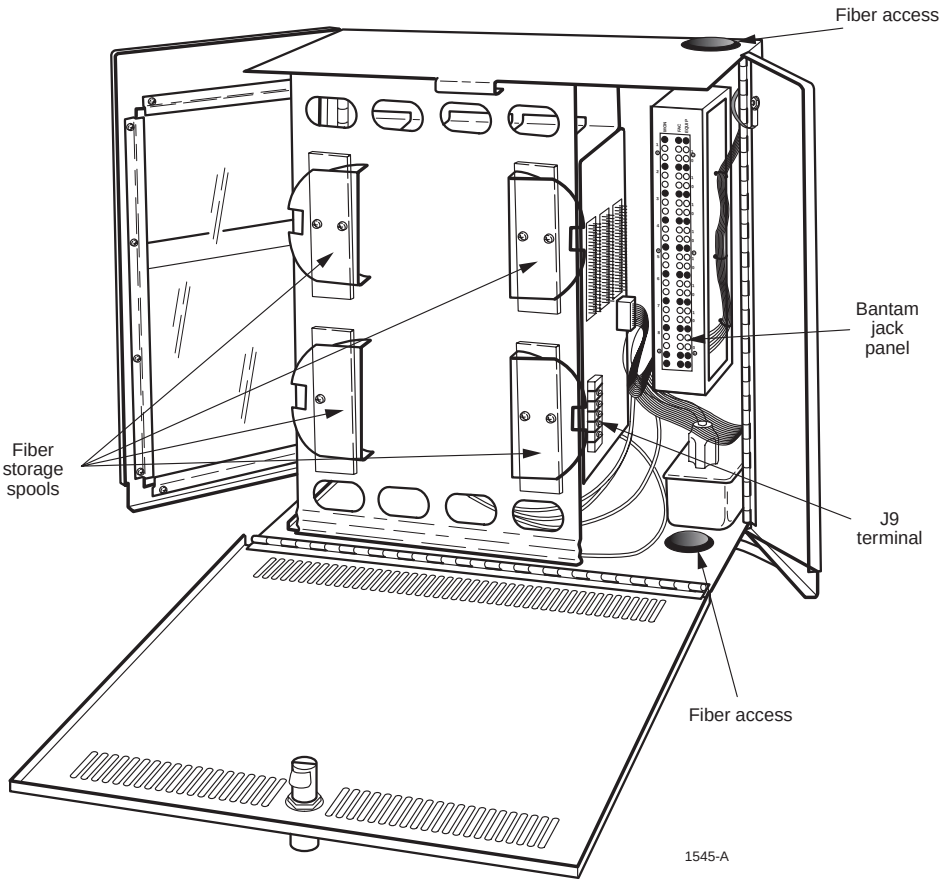


Figure 4. *Fiber Routes*

PROTECTED AND UNPROTECTED CONFIGURATION

- The cabinet can be configured for two protected (PROT) or unprotected (UNPROT) systems.
- Configuration switches are located on the module side of the backplane (see Figure 5 on page 8).

- The cabinet is shipped in either of two ways: optioned or two protected systems. To change the configuration, refer to Table 4.

Table 4. *Configuration Switch Positions*

System	Mounting Position	Switch	Position	DS1/E1 Line
Protect	1 & 2	1 & 2	UP	1 & 2
		5 & 7	DOWN	3 & 4
	3 & 4	3 & 4	UP	1 & 2
		6 & 8	DOWN	3 & 4
Unprotect	1	1 & 2	UP	1 & 2
		5 & 7	UP	3 & 4
	3	3 & 4	UP	1 & 2
		6 & 8	UP	3 & 4

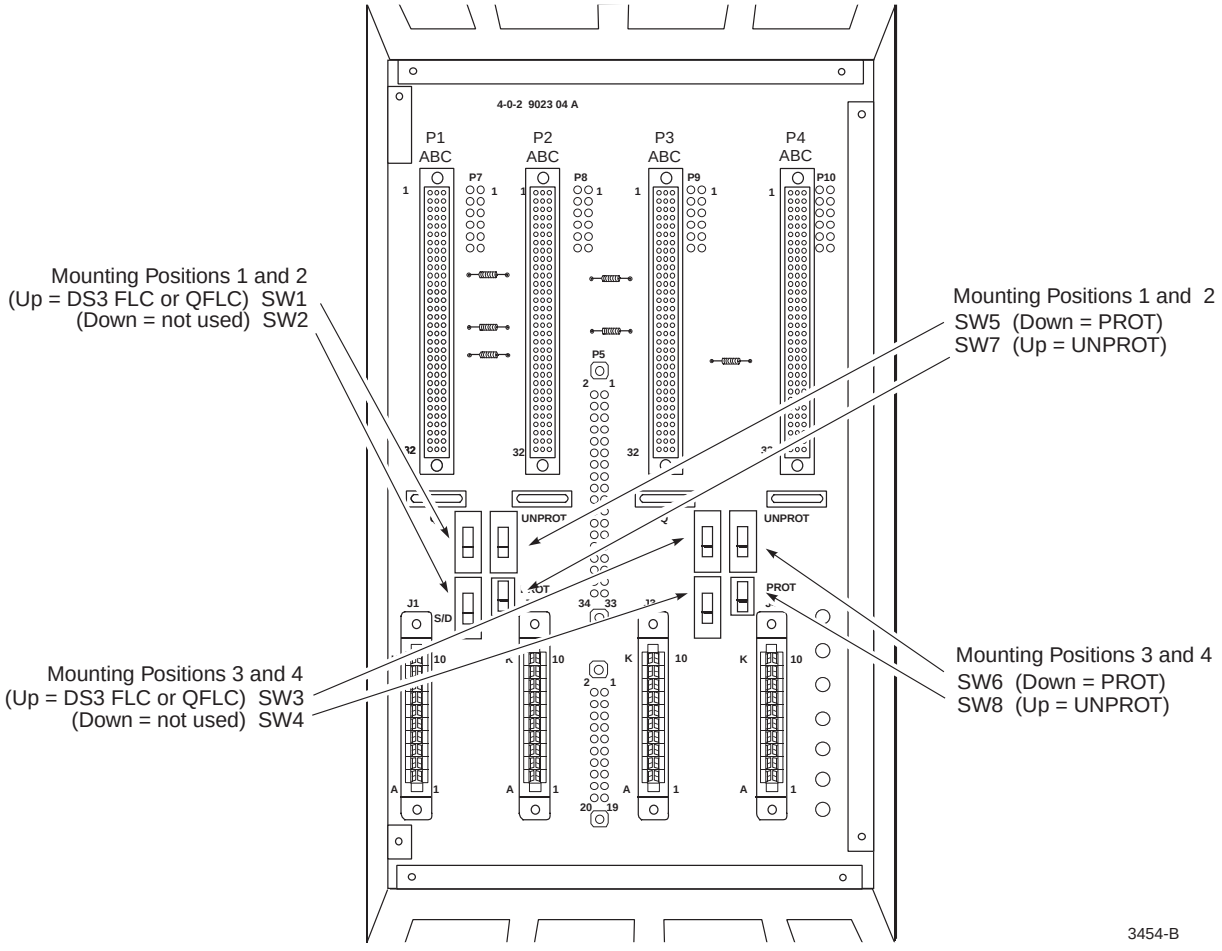


Figure 5. *Configuration Switches*

EIGHT-POSITION UNIVERSAL MOUNTING SHELF

- Model FRM-FAW08B—15.7 H × 11.7 D inches. Mounts in 19- or 23-inch rack and extends 4 or 5 inches in front of the rack. Requires external -48 Vdc power. Front access wire-wrap terminations.
- Model FRM-RAW08B—Same size, mounting, and power requirements as above. Rear access wire-wrap terminations.

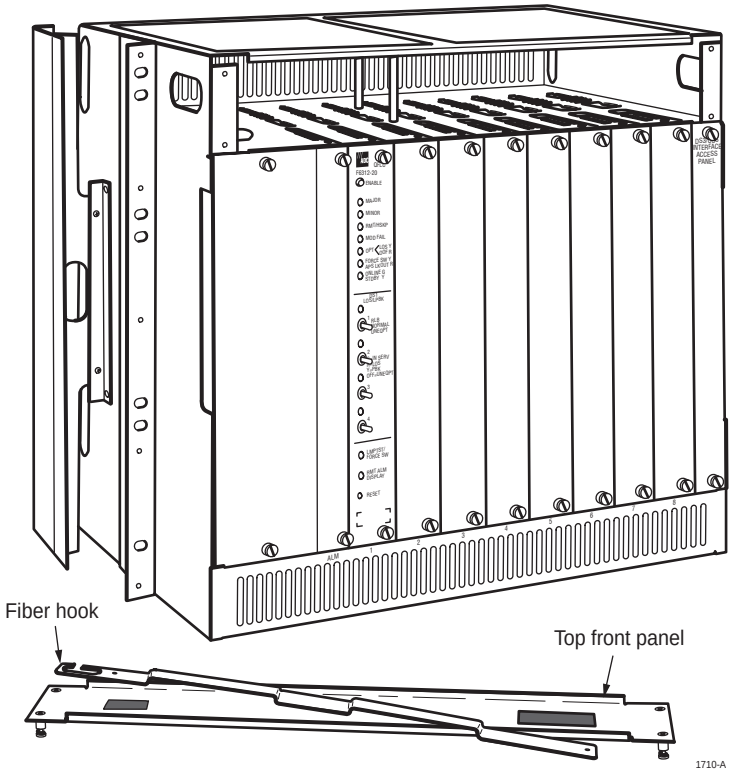


Figure 6. *Eight-Position Universal Mounting Shelf*

CHASSIS INSTALLATION

1. Identify the electrical and fiber-entry holes before installing shelf.
2. If installing in a 19-inch rack, remove the mounting brackets and affix each bracket so the long side is flat against the shelf.
3. Position the mounting brackets so the shelf extends 4 or 5 inches in front of the rack as required.
4. Place the shelf in the relay rack, align the mounting bracket holes with the threaded rack holes, and secure with the machine screws.

For detailed information on reversing the front or rear access, refer to the Eight-Position Universal Mounting Shelf User Manual (see "Related Publications" on page iii).

DS1/E1 LINES—WIRE-WRAP TERMINATIONS

Protect Systems

- Connect up to four DS1/E1 lines to odd-numbered mounting positions (Group) occupied by the Working System as follows (see Figure 7):
  - Group 1 = Mounting Position 1
  - Group 3 = Mounting Position 3
  - Group 5 = Mounting Position 5
  - Group 7 = Mounting Position 7
- Use 22 or 24 AWG twisted pair shielded wire or cable.
- Wire or cable shield stub connections are provided at the terminal block.

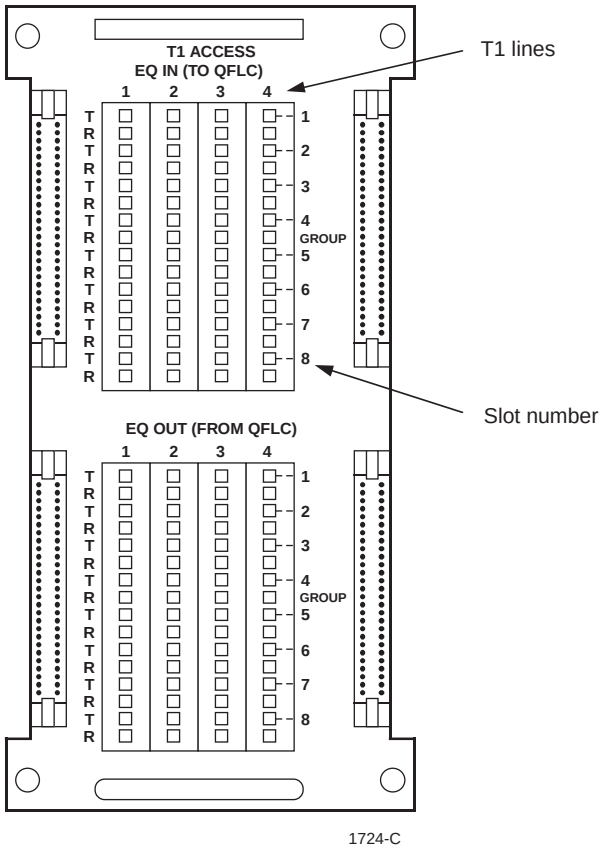


Figure 7. *Wire-Wrap Terminations*

Unprotect Systems

Connect up to four DS1/E1 lines to each mounting position (Group) occupied by an Unprotect System (see Figure 7). Use 22 or 24 AWG twisted pair shielded wire or cable. Wire or cable shield stub connections are provided at the terminal block.

DS1/E1 LINES—CONNECTORIZED TERMINATIONS

Protect Systems

Connect up to four DS1/E1 lines to each odd-numbered mounting position with two (J51 and J53) 50-pin female Champ connectors (see Table 5). Use 22 or 24 AWG twisted pair shielded wire or cable.

Table 5. *J51 and J53 Connections*

DS1/E1 Line	Pin Number	T/R	Mounting Position	EQ IN [a] Connector Number	EQ OUT [b] Connector Number	Mounting Position	EQ IN Connector Number	EQ OUT Connector Number
1	1	R	1	J53	J51	2	J52	J50
	26	T	1			2		
2	2	R	1			2		
	27	T	1			2		
3	3	R	1			2		
	28	T	1			2		
4	4	R	1			2		
	29	T	1			2		
1	5	R	3	J53	J51	4	J52	J50
	30	T	3			4		
2	6	R	3			4		
	31	T	3			4		
3	7	R	3			4		
	32	T	3			4		
4	8	R	3			4		
	33	T	3			4		
1	9	R	5	J53	J51	6	J52	J50
	34	T	5			6		
2	10	R	5			6		
	35	T	5			6		
3	11	R	5			6		
	36	T	5			6		
4	12	R	5			6		
	37	T	5			6		
1	13	R	7	J53	J51	8	J52	J50
	38	T	7			8		
2	14	R	7			8		
	39	T	7			8		

Continued

Table 5. *J51 and J53 Connections (Continued)*

DS1/E1 Line	Pin Number	T/R	Mounting Position	EQ IN [a] Connector Number	EQ OUT [b] Connector Number	Mounting Position	EQ IN Connector Number	EQ OUT Connector Number
3	15	R	7	J53 (cont'd)	J51 (cont'd)	8		
	40	T	7			8		
4	16	R	7			8		
	41	T	7			8		

(a) EQ IN = Equipment input to QFLC module.
(b) EQ OUT = Equipment output from QFLC module.

Protect System mode: Wire to connectors J53 and J51 for the odd-numbered mounting positions.

Unprotect System mode: Wire to the connectors J53, J51, J52, and J50 for all mounting positions.

Unprotect Systems

Connect up to four DS1/E1 lines to each mounting position with four (J51, J52, J53, and J54) 50-pin female Champ connectors (see Table 5 beginning on page 11). Use 22 AWG twisted pair shielded wire or cable.

DS3 LINE INTERFACE ACCESS

DS3 FLCs used in the Eight-Position Universal Mounting Shelf require the DS3 adapter kit, catalog number FRM-DS3KIT-8 (see Figure 8 on page 13), unless more than four Working DS3 FLCs are to be installed. If more than four Working DS3 FLCs are to be installed, the Unprotected DS3 Adapter Kit, catalog number FRM-DS3KIT8-UNP, must be used (see Figure 9 on page 14). Coaxial cable and printed circuit board assembly connects the DS3 input and output signals to the backplane. The MPU/Telemetry Byte-Oriented Serial (TBOS) connector and cable assembly are not used unless an MPU module is installed in the shelf mounting and installation instructions are included with the kit.

If DS3 FLCs share the chassis with QFLCs, place the DS3 FLCs to the left of the QFLCs for FCC EMI compliance.

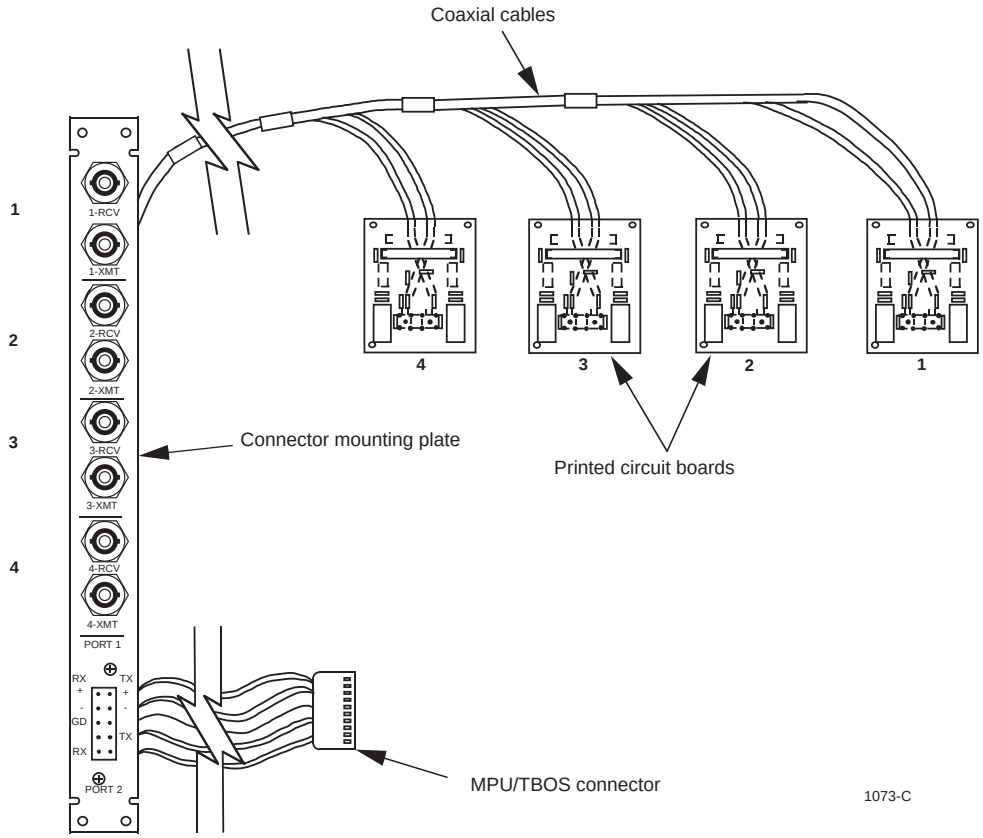


Figure 8. *Protected DS3 Adapter Kit*

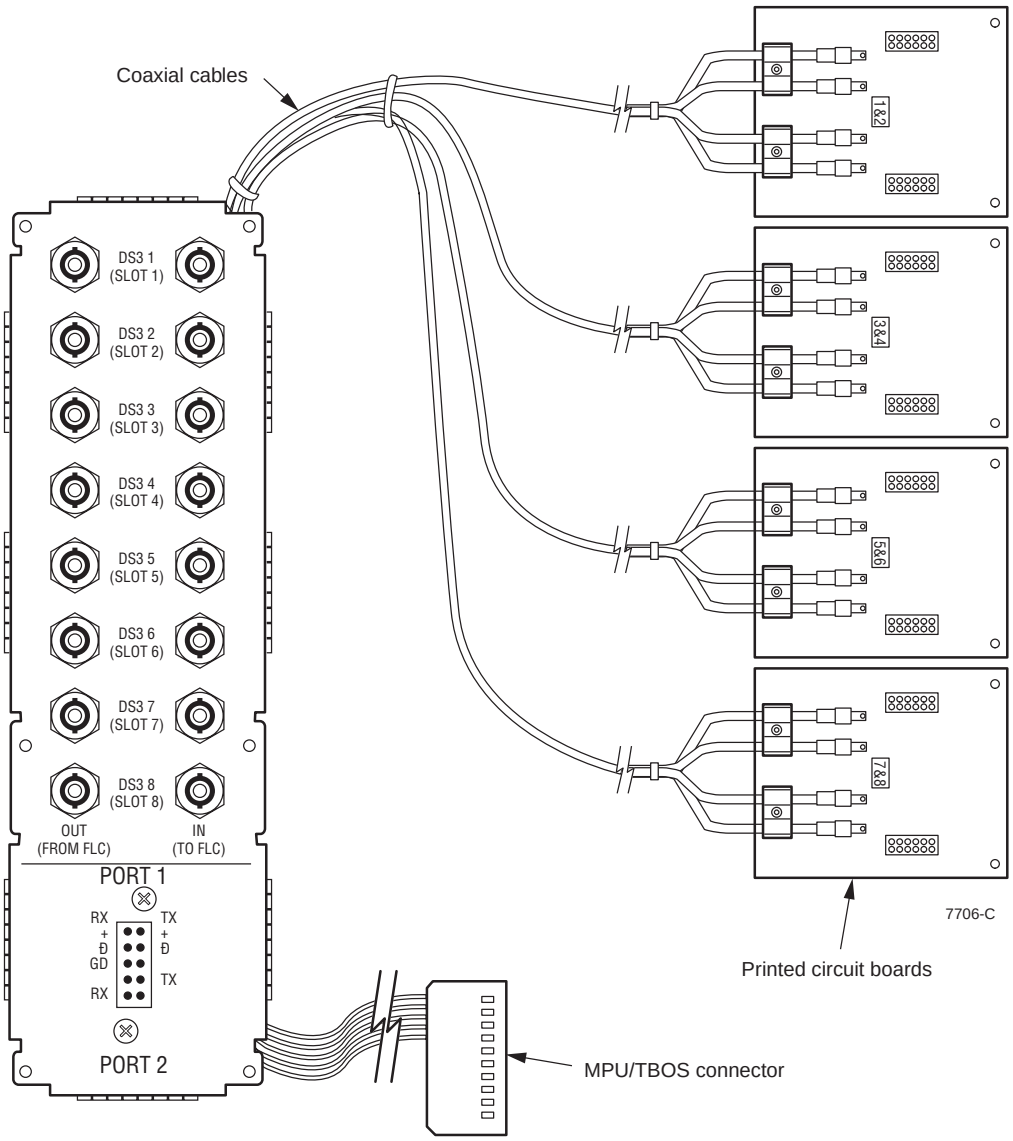


Figure 9. *Unprotected DS3 Adapter Kit*

ALARMS AND POWER

Major and Minor alarms

Major (MAJ) and Minor (MIN) Normally Open (NO) and Common (COM) alarm terminals for the shelf connect to wire-wrap terminals located in the leftmost compartment of the shelf (see Figure 10 on page 15). Use 24 AWG wire.

Remote Alarms

Remote NO and COM alarm terminals for each mounting position connect to wire-wrap terminals (see Figure 10 on page 15).

Housekeeping Alarms

Housekeeping alarm terminal for each mounting position connect to wire-wrap terminals (see Figure 10). Housekeeping alarm for user-selected equipment is activated by a closed loop. Use 24 AWG wire.

Power

Using 18 AWG wire, connect the two -48 Vdc power feeds (A and B) to screw down terminals on the alarm terminal block (Figure 10). Fuse in the same bay with external fuse on each -48 Vdc feed not to exceed 5 Amps. Connect frameground to the terminal block. (See "Appendix A - Alarm Information" on page 81.)

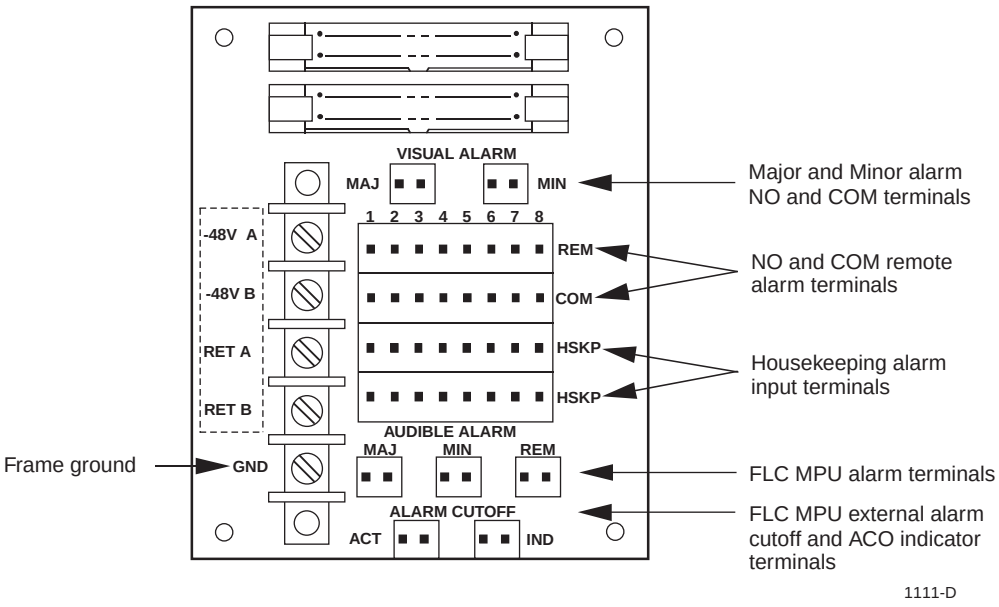


Figure 10. *Power and Alarm Connections*

FIBER INSTALLATION

Danger: Do not look into the ends of any optical fiber. Exposure to invisible laser radiation may result.

Caution: Minimum bend radius for fiber is 1.5 inches. Avoid making sharp bends.

1. Remove the upper front panel. A fiber hook is attached to the inside of the panel. Fibers may enter the shelf through any of two entry holes on each side panel.
2. Route the fiber connectors into the entry holes. If the fibers enter through the rear entry hole, use the fiber hook to catch the fibers by the connectors.
3. Carefully draw the fibers out until they extend about 10 inches in front of the shelf. In late model shelves, top panel fiber guides are provided.

QFLCs or DS3 FLCs placed in odd- or even-numbered mounting positions should be optically connected to remote FLCs in odd- or even-numbered mounting positions, respectively.

PROTECTED AND UNPROTECTED CONFIGURATION

- The shelf can be configured for four protected QFLC or DS3 FLC systems, eight unprotected QFLC, four unprotected DS3 FLC systems, eight unprotected DS3 FLC systems (when using the Unprotected DS3 Adapter Kit, catalog number FRM-DS3KIT8-UNP), or a combination of them. See "Appendix C - Universal Wall Mount and Mounting Shelf Position Usage" on page 83.

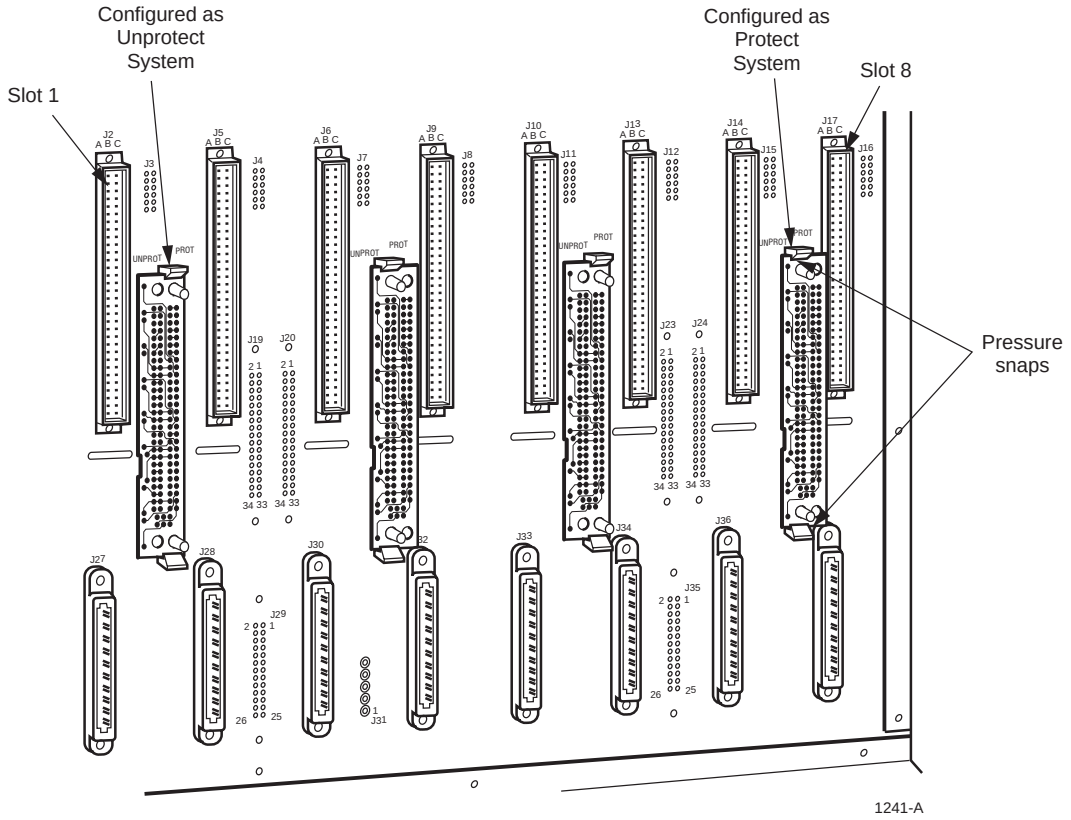
Shelf is factory shipped in Protect System configuration.

- The position of the jumper boards on the backplane determine the protected/unprotected configuration of each slot pair. In the Eight-Position shelf, slot 1 is paired with slot 2, slot 3 with slot 4, and so on (see Figure 11). To change the configuration of the slot pair, proceed as follows:

  1 Release the white top and bottom jumper board snaps and remove the board from the connector.

  2 Place the jumper boards top and bottom right-side holes (for unprotected system) or left-side holes (for protected system) over the top and bottom white posts as shown in Figure 11 on page 17.

  3 Press the jumper board back into the connector until the top and bottom snaps are engaged with the board.



Slots 1-2 and 5-6 are configured for unprotected system operation.
Slots 3-4 and 7-8 are configured as protected systems.

Figure 11. *Slot Pairing*

QUAD TWO-POSITION HORIZONTAL MOUNTING SHELF (23-INCH)

- Model FRM-FAW02B—4 H × 23 W × 12 D inches. Mounts in a 23-inch rack or on a wall with Adapter Kit FLC-HDW007. Wire-wrap terminations. -48 Vdc powered.

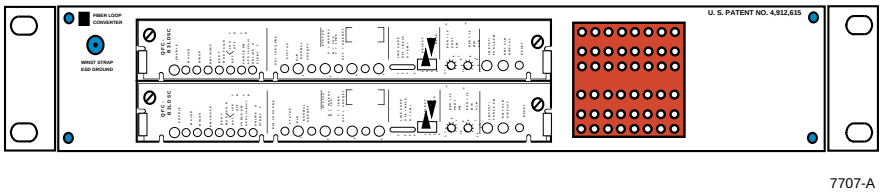


Figure 12. *Quad Two-Position Horizontal Mounting Shelf (23-inch)*

CHASSIS INSTALLATION

The shelf installs in a 23-inch rack or with Adapter Kit FLC-HDW007 as a wall mount unit. (Installation instructions included with the kit.)

1 Adjust the mounting brackets on the side of the shelf so that it mounts flush or extends 0.5, 1.0, 1.5, 2.0, 4.0, 4.5, or 5 inches in front of the rack, as required. If the shelf is flush-mounted or extends less than 4 inches in front of the rack, the front entry holes on both side panels are partially covered by the mounting brackets.

2 Align the mounting bracket holes on each side of the shelf with the threaded holes in the rack and secure with #12-24 screws.

DS1/E1 LINES

Use 22 or 24 AWG shielded twisted pair wire or ABAM (or equivalent cable) when making DS1/E1 line connection. Refer to the Figure 13 on page 20 for definitions of the DS1/E1 pin locations.

1 Remove the front cover by removing the four captive screws.

2 Connect the four DS1/E1 transmit and receive pairs for the slot 1 (lower) module to pin pairs 1 through 4 of the EQ OUT and EQ IN wire-wrap pin blocks.

3 In an unprotected system, connect the four DS1/E1 transmit and receive pairs for the slot 2 (upper) module to pin pairs 5 through 8 of the EQ OUT and EQ IN wire-wrap pin blocks.

4 Replace the front panel when installation connections are complete.

In a protected configuration, all eight DS1/E1 interfaces may be connected if future provisioning requires changing a Protect System to an unprotected configuration.

POWER AND ALARM INSTALLATION

1. Remove the front cover by removing the four captive screws.
2. Connect the office frameground to the -48 Vdc terminal block ground (GND) screw down terminal (see Figure 13 on page 20). Use a #6 ring lug with Green 22 AWG wire to make the ground connection.

The shelf must be properly grounded before applying power or inserting FLC modules.

3. Connect the -48 Vdc terminal block, -48 A and RET A (-48 Vdc and return) to a local -48 Vdc power source. Connect the -48 B and RET B terminals to an alternate local -48 Vdc power source. Use #6 ring lugs with 22 AWG wire and fuse externally with 3 Amp fuses.
4. As required, connect local alarm surveillance equipment to the Major (MAJ) and Minor (MIN) Normally Open (NO) and Common (COM) wire-wrap pins on the terminal block. Use 24 AWG wire.
5. As required, connect the Remote alarm reporting equipment to the NO and COM wire-wrap pins on the terminal block. Use 24 AWG wire. Pins labeled BOT are connected to slot 1 (lower) and pins labeled TOP are connected to slot 2 (upper).
6. As required, connect the Housekeeping alarm inputs to HSKP terminals A and B. The Housekeeping alarm Relay is operated by a short (loop) furnished by local equipment. Use 24 AWG wire. Pins labeled BOT are connected to slot 1 (lower) and pins labeled TOP are connected to slot 2 (upper).

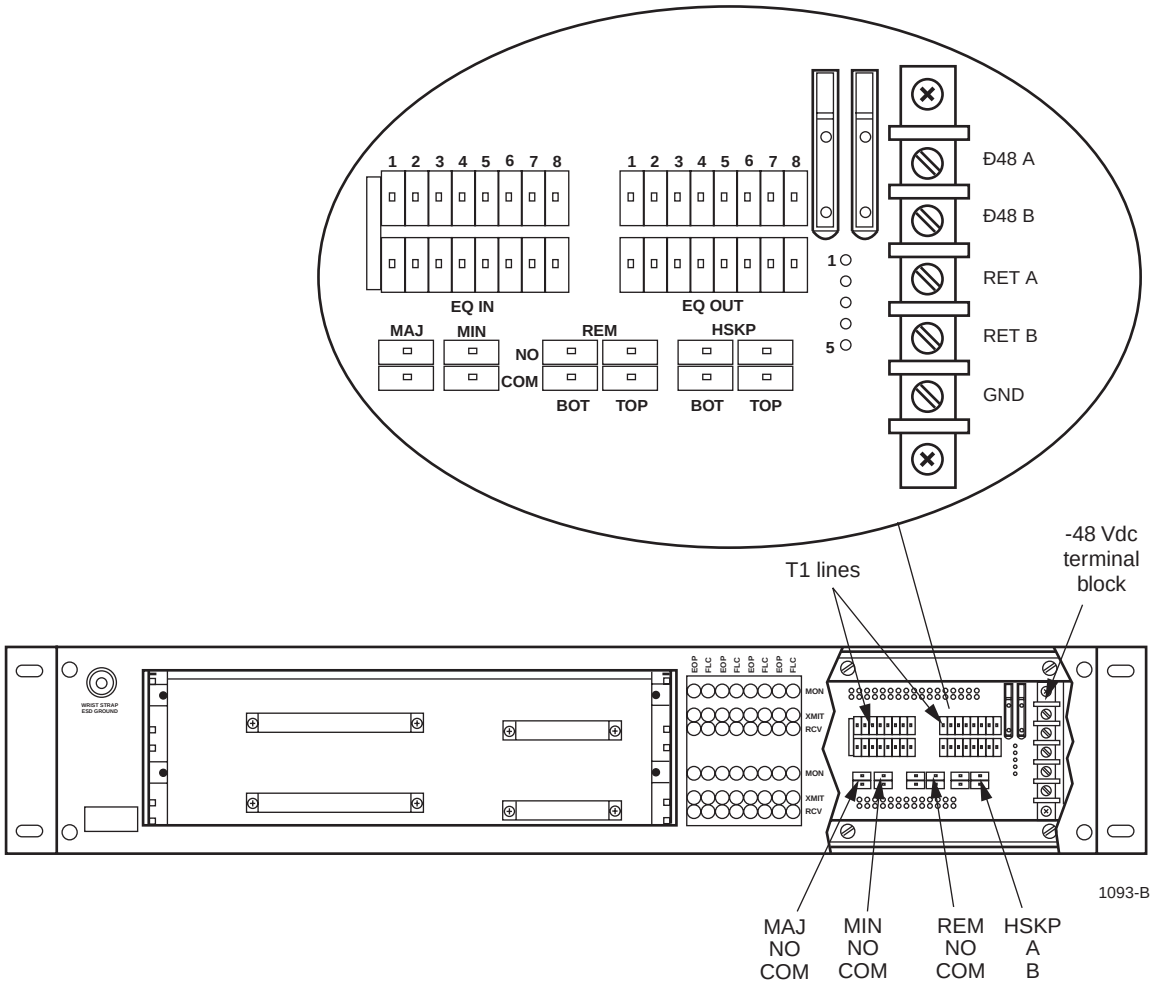


Figure 13. *Installer Connections*

FIBER INSTALLATION

Route the fiber cables into the shelf through the front or rear left-side entry holes until the connectors extend about 8 inches in front of the shelf. The slack is required for connection to the FLC modules.

A QFLC placed in an odd- (BOT) or even- (TOP) numbered slot should be optically connected to a remote QFLC in an odd- or even-numbered slot, respectively.

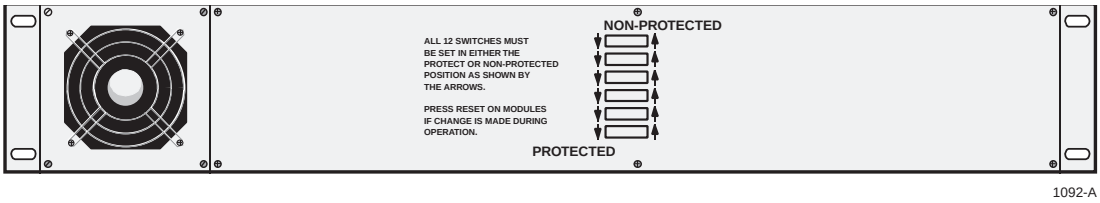

NON-PROTECTED
ALL 12 SWITCHES MUST BE SET IN EITHER THE PROTECT OR NON-PROTECTED POSITION AS SHOWN BY THE ARROWS.
PRESS RESET ON MODULES IF CHANGE IS MADE DURING OPERATION.
PROTECTED
1092-A

Figure 14. *Protect/Unprotect Switches*

PROTECTED AND UNPROTECTED CONFIGURATION

The shelf is configured as protected or unprotected by setting configuration switches located inside the back panel (Figure 14 on page 20). Remove the back panel to access the switches. Set all 12 switches to the UP position for unprotected configuration and to the DOWN position for protected configuration.

In the protected configuration, the Working System module resides in the lower slot (slot 1), and the protected module above it (slot 2).

TEST JACKS

Monitor (MON), Transmit (XMT), and Receive (RCV) front-panel Bantam test jacks are provided for signal path monitoring and patching. The MON jack provides a signal at about 20 dB below the DS1/E1 level (see Figure 15.)

Test jacks are defined as follows:

- EQP MON—Provides DS1/E1 monitoring access to the receive signal from the connected T1/E1 line.
- FLC MON—Provides DS1/E1 monitoring access to the receive signal from the Fiber Loop Converter.
- EQP XMT—Provides DS1/E1 access to the transmit signal to the connected T1/E1 line while simultaneously breaking the signal path from the Fiber Loop Converter.
- FLC XMT—Provides DS1/E1 access to the transmit signal to the Fiber Loop Converter while simultaneously breaking the signal from the T1/E1 line.
- EQP RCV—Provides DS1/E1 access to the receive signal from the connected T1/E1 line while simultaneously breaking the signal path to the Fiber Loop Converter.
- FLC RCV—Provides DS1/E1 access to the receive signal from the Fiber Loop Converter while simultaneously breaking the signal path to the connected T1/E1 line.

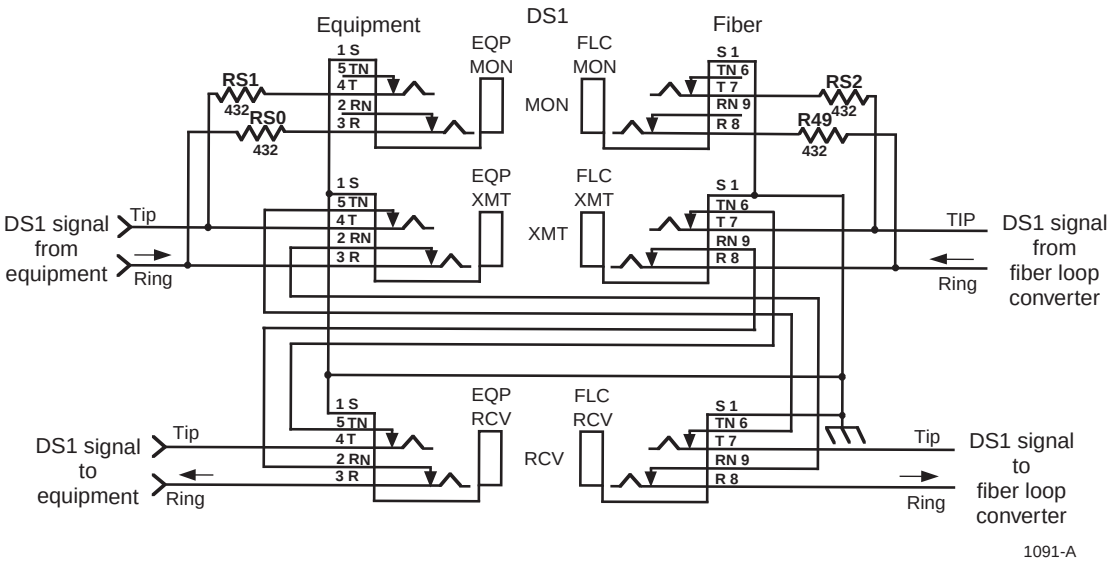


Figure 15. *Test Jack Wiring Diagram*

QUAD TWO-POSITION HORIZONTAL MOUNTING SHELF (19-INCH)

- Model FRM-FAW02D—4 H × 19 W × 12 D inches. Mounts in a 19-inch rack or on a wall with Adapter Kit FLC-HDW007. Wire-wrap terminations. -48 Vdc powered.

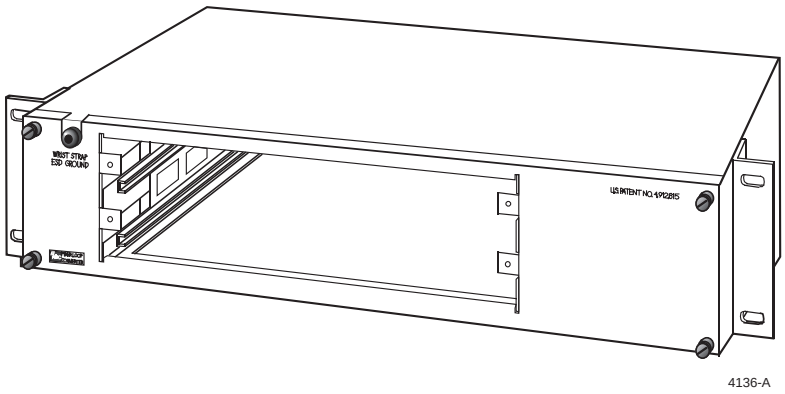


Figure 16. *Quad Two-Position Horizontal Mounting Shelf (19-inch)*

CHASSIS INSTALLATION

The shelf installs in a 19-inch rack or with Adapter Kit FLC-HDW007 as a wall mount unit (installation instructions included with the kit).

1 Adjust the mounting brackets on the side of the shelf so that it mounts flush or extends 0.5, 1.0, 1.5, 2.0, 4.0, 4.5, or 5 inches in front of the rack, as required. If the shelf is flush-mounted or extends less than 4 inches in front of the rack, the front entry holes on both side panels are partially covered by the mounting brackets.

2 Align the mounting bracket holes on each side of the shelf with the threaded holes in the rack and secure with #12-24 screws.

DS1/E1 LINES

Use 22 or 24 AWG shielded twisted pair wire or ABAM (or equivalent cable) when making DS1/E1 line connections. Refer to Figure 17 on page 24 for definitions of the DS1/E1 pin locations.

1 Remove the front cover by removing the four captive screws.

2 Connect the four DS1/E1 transmit and receive pairs for the slot 1 (lower) module to pin pairs 1 through 4 of the EQ OUT and EQ IN wire-wrap pin blocks.

3 In an unprotected system, connect the four DS1/E1 transmit and receive pairs for the slot 2 (upper) module to pin pairs 5 through 8 of the EQ OUT and EQ IN wire-wrap pin blocks.

4 Replace the front panel when installation connections are complete.

In a protected configuration, all eight DS1/E1 interfaces may be connected if future provisioning requires changing a Protect System to an unprotected configuration.

POWER AND ALARM INSTALLATION

Refer to Figure 17 on page 24 as you perform the following steps.

1 Remove the front cover by removing the four captive screws.

2 Connect the office frameground to the -48 Vdc terminal block ground (GND) screw down terminal. Use a #6 ring lug with Green 22 AWG wire to make the ground connection

The shelf must be properly grounded before applying power or inserting FLC modules.

3 Connect the -48 Vdc terminal block, -48 A and RET A (-48 Vdc and return) to a local -48 Vdc power source. Connect the -48 B and RET B terminals to an alternate local-48 Vdc power source. Use #6 ring lugs with 22 AWG wire and fuse externally with 3 Amp fuses.

4 As required, connect local alarm surveillance equipment to the Major (MAJ) and Minor (MIN) Normally Open (NO) and Common (COM) wire-wrap pins on the terminal block. Use 24 AWG wire.

5 As required, connect the Remote alarm reporting equipment to the NO and COM wire-wrap pins on the terminal block. Use 24 AWG wire. Pins labeled BOT are connected to slot 1 (lower) and pins labeled TOP are connected to slot 2 (upper).

6 As required, connect the Housekeeping alarm inputs to HSKP terminals A and B. The Housekeeping alarm Relay is operated by a short (loop) furnished by local equipment. Use 24 AWG wire. Pins labeled BOT are connected to slot 1 (lower) and pins labeled TOP are connected to slot 2 (upper).

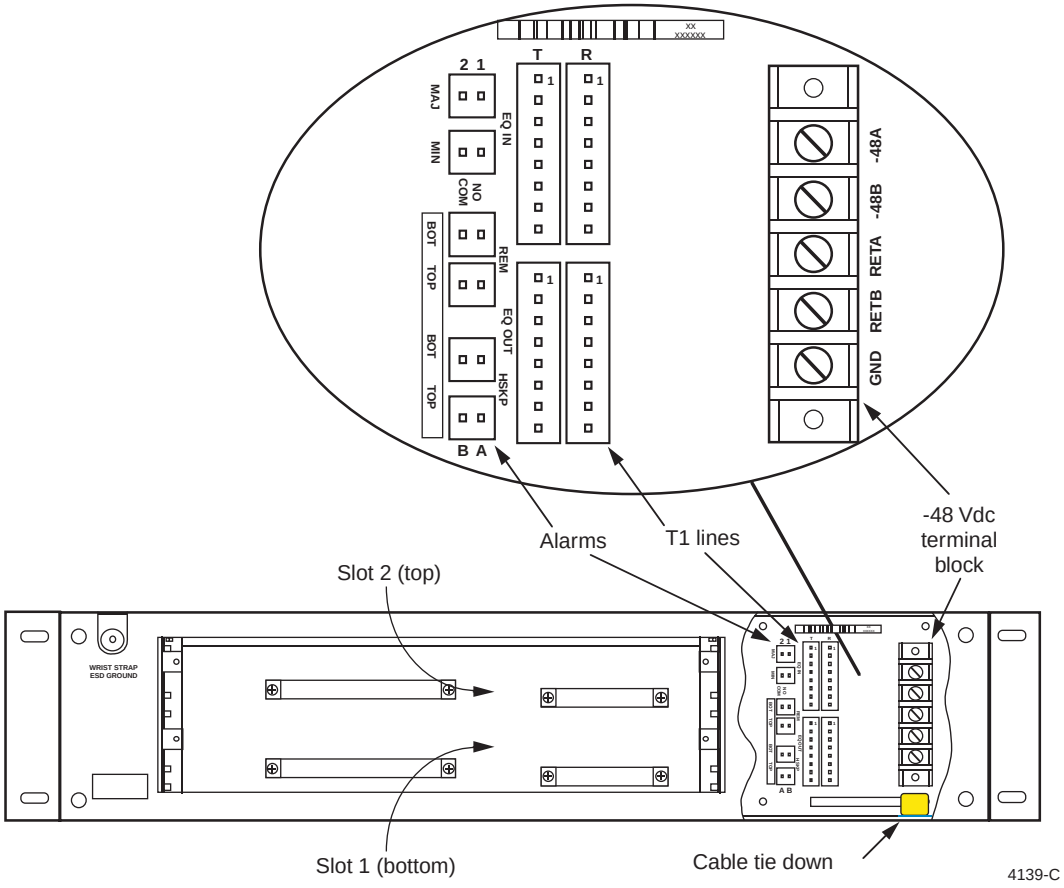


Figure 17. *Installer Connections*

FIBER INSTALLATION

Route the fiber cables into the shelf through the front or rear left-side entry holes until the connectors extend about 8 inches in front of the shelf. The slack is required for connection to the FLC modules.

A QFLC placed in an odd- (BOT) or even- (TOP) numbered slot should be optically connected to a remote QFLC in an odd- or even-numbered slot, respectively.

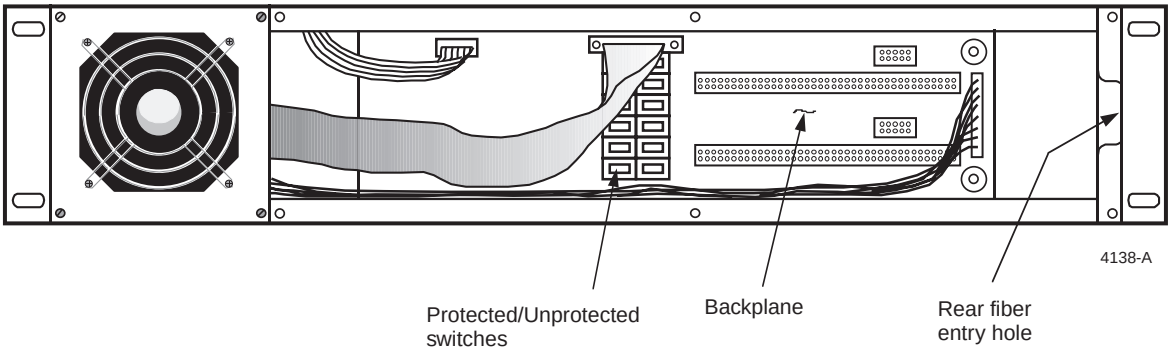


Figure 18. *Protect/Unprotect Switches*

PROTECTED AND UNPROTECTED CONFIGURATION

The shelf is configured as protected or unprotected by setting configuration switches located inside the back panel (see Figure 18 on page 25). Remove the back panel to access the switches. Set all 12 switches to the UP position for unprotected configuration, and to the DOWN position for protected configuration.

In the protected configuration, the Working System module resides in the lower slot (slot 1), and the protected module above it (slot 2).

DS3/QUAD 23" TWO-POSITION HORIZONTAL MOUNTING SHELF

The DS3/Quad FLC Two-Position Horizontal Mounting Shelf accommodates DS3 FLCs in one protected or one unprotected configuration, or Quad Fiber Loop Converters (QFLCs) in one protected or two unprotected configurations. Following is the model number and shelf information:

- Model FRM-FAW02C—4 H × 23 W × 12 D inches. Mounts in a 23-inch rack or on a wall with Adapter Kit FLC-HDW007. BNC DS3 terminations and wire-wrap DS1/E1 terminations. -48 Vdc powered.

The 23" two-position horizontal mounting shelf accomodates either the DS3 FLC or the Quad FLC.

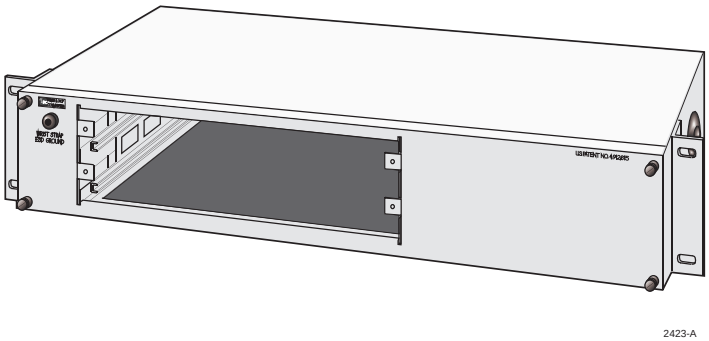


Figure 19. *Two-Position Horizontal Mounting Shelf*

CHASSIS INSTALLATION

The shelf installs in a 23-inch rack or with Adapter Kit FLC-HDW007 as a wall mount unit (installation instructions included with the kit).

1 Adjust the mounting brackets on the sides of the shelf so that it extends 2, 4, or 5 inches in front of the rack, as required. If the shelf is flush-mounted or extends only 1 inch, the front-cable entry hole on the right side panel is covered restricting access of the DS3 cables to the DS3 BNC connectors.

2 Align the mounting bracket holes on each side of the shelf with the threaded holes in the rack and secure with #12-24 screws.

POWER AND ALARM INSTALLATION

Refer to Figure 20 on page 28 as you perform the following steps.

1 Remove the front cover by removing the four captive screws.

2 Connect the office frameground to the -48 Vdc terminal block ground (GND) screw down terminal. Use a #6 ring lug with Green 22 AWG wire to make the ground connection.

The shelf must be properly grounded before applying power or inserting FLC modules.

3 Connect the -48 Vdc terminal block, -48 A and RET A (-48 Vdc and return) to a local -48 Vdc power source. Connect the -48 B and RET B terminals to an alternate local -48 Vdc power source. Use #6 ring lugs with 22 AWG wire and fuse externally with 3 Amp fuses.

4 As required, connect local alarm surveillance equipment to the Major (MAJ) and Minor (MIN) Normally Open (NO) and Common (COM) wire-wrap pins on the terminal block. Use 24 AWG wire.

5 As required, connect the Remote alarm reporting equipment to the NO and COM wire-wrap pins on the terminal block. Use 24 AWG wire. Pins labeled BOT are connected to slot 1 (lower) and pins labeled TOP are connected to slot 2 (upper).

6 As required, connect the Housekeeping alarm inputs to HSKP terminals A and B. The Housekeeping alarm Relay is operated by a short (loop) furnished by local equipment. Use 24 AWG wire. Pins labeled BOT are connected to slot 1 (lower) and pins labeled TOP are connected to slot 2 (upper).

DS3 CABLES (DS3 FLC APPLICATION)

1 Remove the front panel of the shelf.

2 Route the DS3 cables through the entry hole on the front right side of the shelf (see Figure 21 on page 28).

3 Connect the cables to the BNC connectors near the DS1/E1 wire-wrap pins. Connect the DS3 equipment input to the upper BNC connector (labeled RCV), and the DS3 equipment output to the lower BNC connector (labeled XMT).

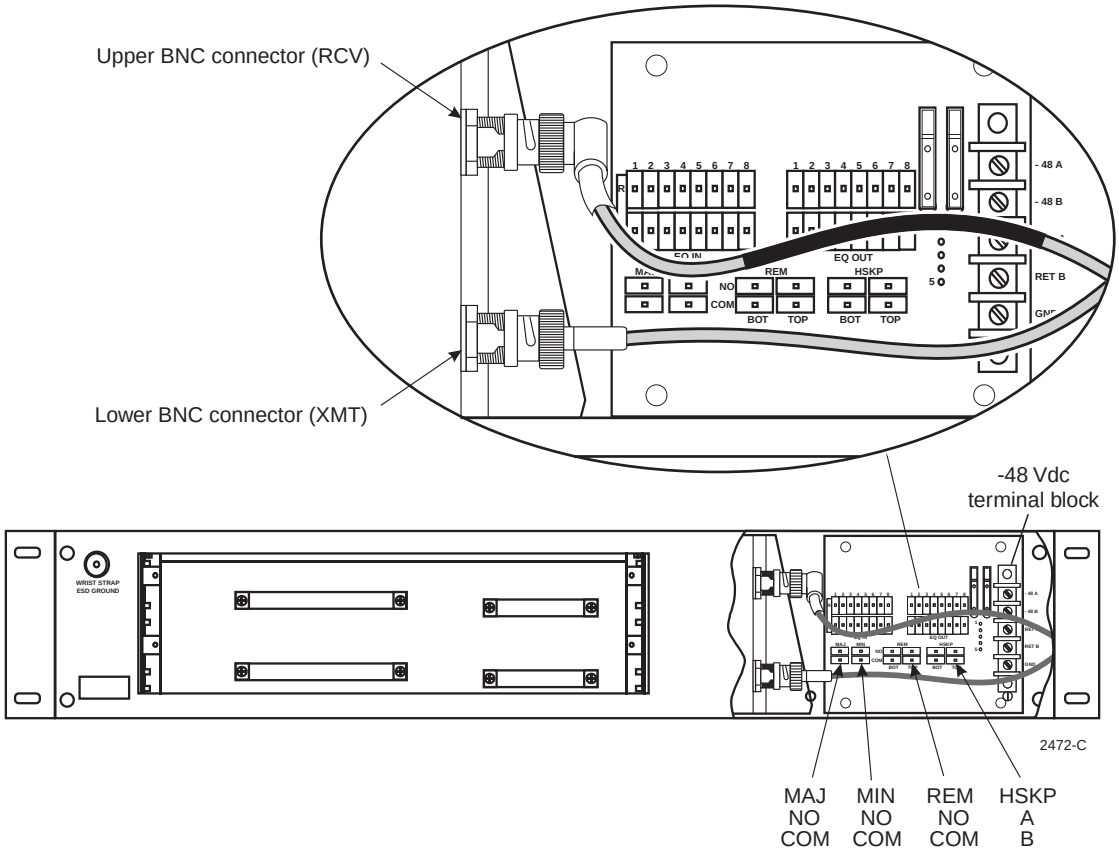


Figure 20. *Installer Connections*

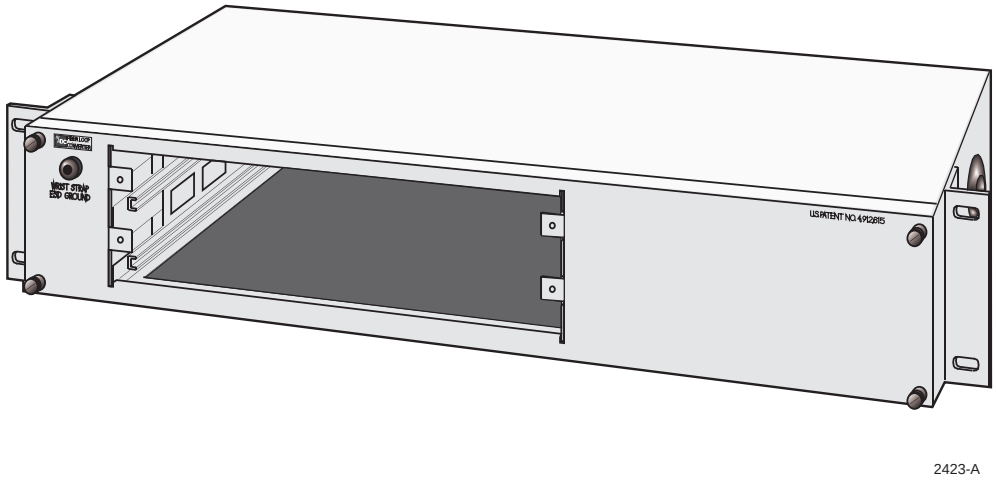


Figure 21. *Fiber and DS3 Cable Routing*

DS1/E1 LINES (QUAD FLC APPLICATION)

Use 22 or 24 AWG shielded wire or ABAM (or equivalent cable) when making DS1/E1 line connection. Refer to Figure 20 on page 28 for definitions of the DS1/E1 pin locations.

1 Remove the front cover by removing the four captive screws.

2 Connect the four DS1/E1 transmit and receive pairs for the slot 1 (lower) module to pin pairs 1 through 4 of the EQ OUT and EQ IN wire-wrap pin blocks.

3 In an unprotected system, connect the four DS1/E1 transmit and receive pairs for the slot 2 (upper) module to pin pairs 5 through 8 of the EQ OUT and EQ IN wire-wrap pin blocks.

4 Replace the front panel when installation connections are complete.

In a protected configuration, all eight DS1/E1 interfaces may be connected if future provisioning requires changing a Protect System to an unprotected configuration.

FIBER INSTALLATION

Route the fiber cables into the shelf through the front or rear left-side entry holes until the connectors extend about 8 inches in front of the shelf. The slack is required for connection to the FLC modules.

DS3 FLCs and QFLCs placed in odd- or even-numbered slots should be optically connected to remote FLCs in odd- or even-numbered slots, respectively.

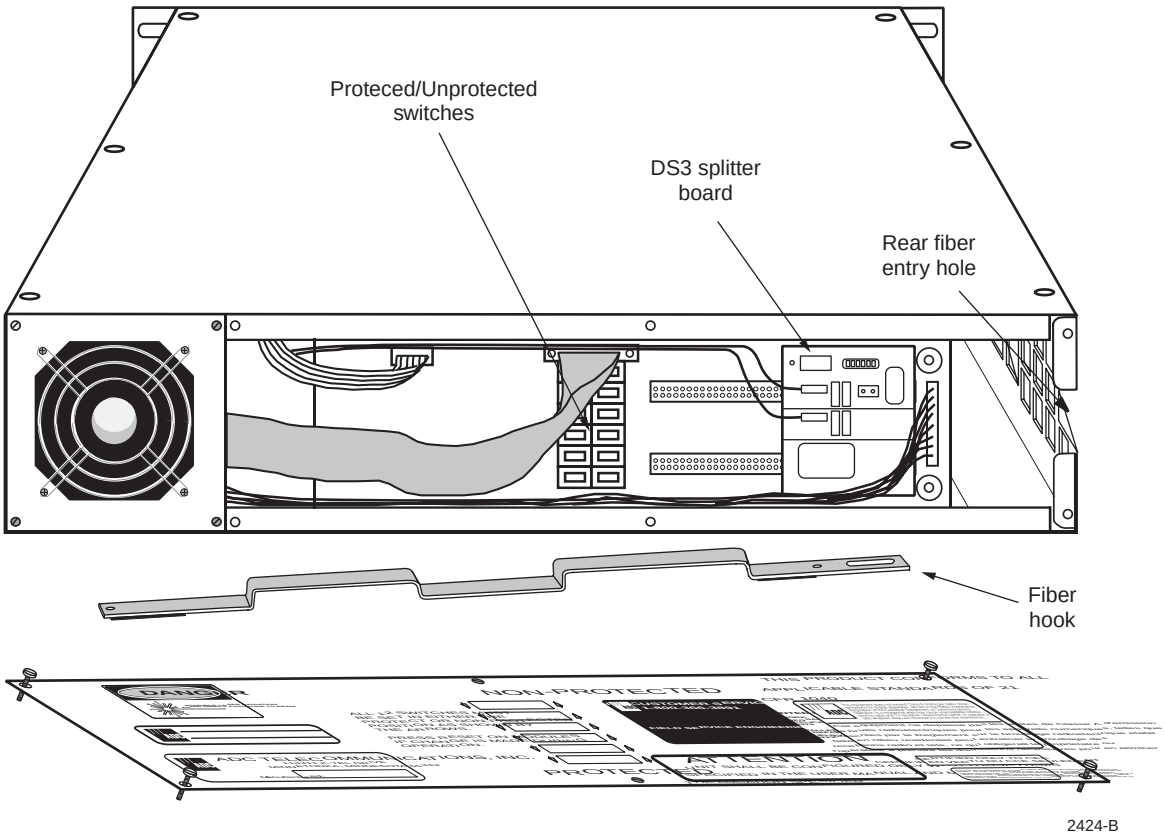


Figure 22. *Protect/Unprotect Switches*

PROTECTED AND UNPROTECTED CONFIGURATION

The shelf is configured as protected or unprotected by setting configuration switches located inside the back panel (see Figure 22 on page 29). Remove the back panel to access the switches. Set all 12 switches to the UP position for unprotected configuration. The Working System module resides in the lower slot (slot 1) and the protected module above it (slot 2).

The chassis serves only one DS3, whether it is protected or unprotected. It does not serve two unprotected DS3s.

FLC MODULE FEATURES

Table 6 describes the features of the DS1, E1, and DS3 Fiber Loop Converters. Refer to Table 7 on page 32 for Fiber Loop Converter electrical and optical specifications.

Table 6. *Quad DS1, E1, and DS3 Version FLC Features*

Feature	Quad FLC B2, B3, and D3 [a]	DS3 FLC	E1 Quad FLC B2
Extended Temperature module (-40 to +65°C = DS1/E1) (-40 to +70°C = E1)	Yes (D3)	Yes	Yes
Configure module as Master or Remote module	Yes	No	Yes
Optical fiber 9/125 single mode	Yes	Yes	Yes
Approximate transmission miles	24	14	24
Number of fibers used	2	2	2
Fiber connector	PC/FC, SC	PC/FC,SC	PC/FC
Wave length	1305 nm, 1310 nm (D3)	1305 nm	1305 nm
Optical Budget	22 dB	13 dB	22 dB
Number of T1/E1 lines	4	N/A	4
DS1/E1 output signal range from 0 to 655 feet	Yes	N/A	Within CCITT G.703 template and level standards
Current option	60 mA simplex	N/A	250 mA typical @ -48 Vdc 336 mA maximum @ -48 Vdc
Accepts AMI and B8ZS	Yes	B3ZS	No
Loopback circuit	Yes	Yes	Yes
Alarm indication signal	Yes	Yes	Yes
Major and Minor alarm	Yes	Yes	Yes
Remote alarm relay	Yes	Yes	Yes
Site (Housekeeping) alarm	Yes	Yes	Yes
Incoming DS1/E1 signal failure alarm cutoff option	Yes	Yes (DS3)	No
1 + 1 Automatic Protection Switching (APS)	Yes	Yes	Yes
BER threshold-user selectable	Yes [b]	No	Yes
Remote configuration matching	Yes [c]	No	Yes
TBOS command provisioning	Yes [c]	Yes	Yes

(a) U.S. Patent 5,047,735.
(b) B2, B3 and D3 only.
(c) B3 and D3 only.

Table 7. *FLC Electrical and Optical Specification*

Model	Type	Electrical Input Level	Electrical Output Power	Optical Output Power	Optical Receiver Dynamic Range	Optical Budget	Comments
QFC-B2LDFC QFC-B2LDSC	B2 QFLC	0 to -6.0 dB	Within DSX-1 template	-6.0 dBm ±3.0 dB	-7.0 to -31.0 dBm	22.0 dB	
QFC-B3LDFC QFC-B3LDSC	B3 QFLC	0 to -6.0 dB	Within DSX-1 template	-6.0 dBm ±3.0 dB	-7.0 to -31.0 dBm	22.0 dB	Automatic configuration matching
QFC-D3LDSC QFC-D3LDFC	D3 QFLC	0 to -6.0 dB	Within DSX-1 template	-6.0 dBm ±2.0 dB/-3.0 dB	-4.0 to -31.0 dBm	22.0 dB	Extended temperature and automatic configuration matching
DS3-B2LDFC DS3-B2LDSC	DS3 FLC	+ 5.7 to -7.3 dBm	+ 3.7 dBm ±2.0 dBm with LBO	-8.0 to -15.0 dBm	-8.0 to -28.0 dBm, BER not > 10^{-12}	not < 1.0 dB	FC, FC/PC or optical connector (determined by model number)
E1Q-B2LDFC	B2 E1 QFLC	0 t -6.0 dB	Within CCITT G.703 template and level standards	-6.0 dBm ±3.0 dB	-6.0 to 31.0 dBm	22.0 dB	

QUAD FLC B2, B3, AND D3 MODULES

OPTIONS

Caution: Electrostatic Discharge (ESD) protection must always be used while handling circuit cards. An ESD grounding jack is provided on the mounting chassis.

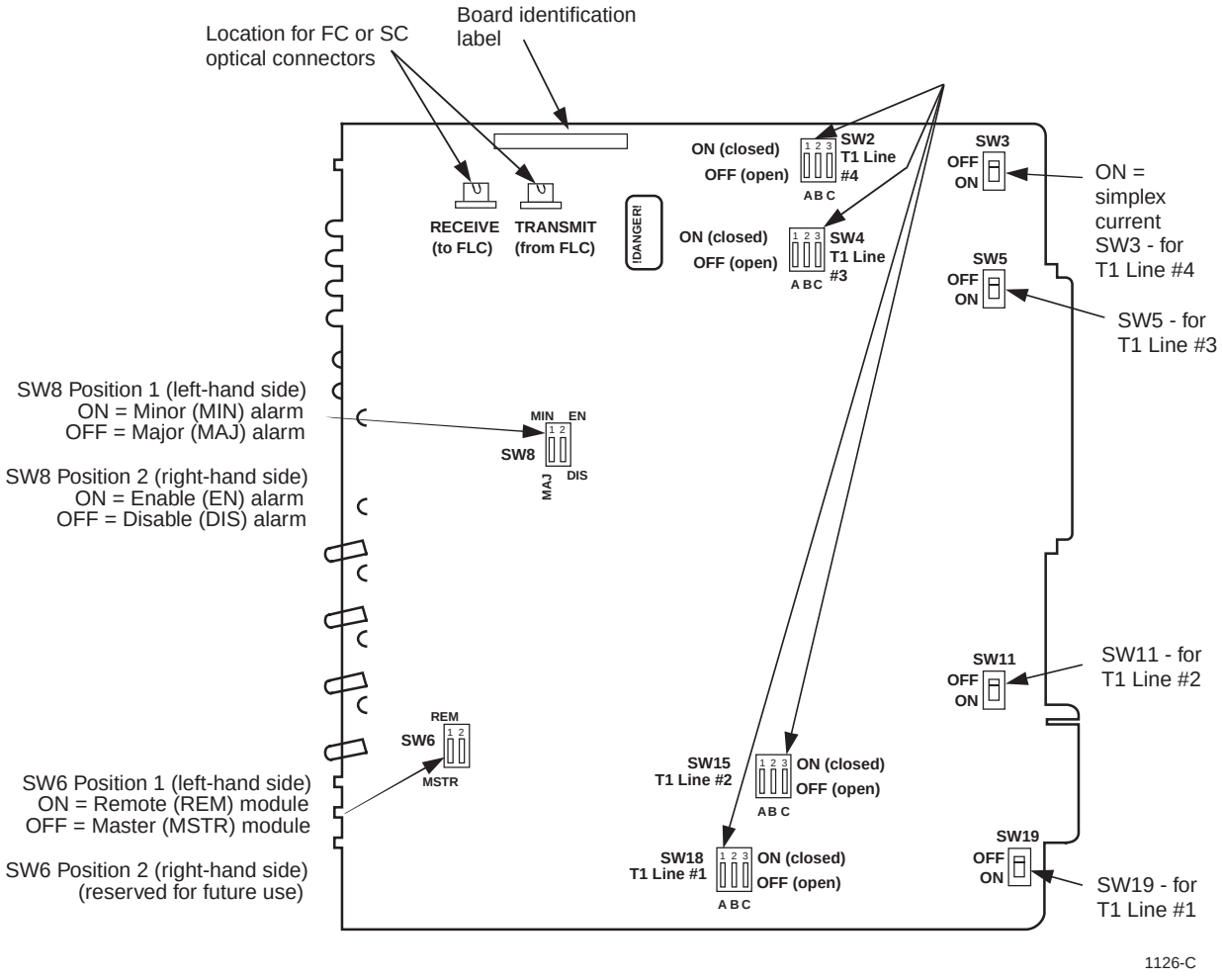


Figure 23. *B2 QFLC and B3 QFLC*

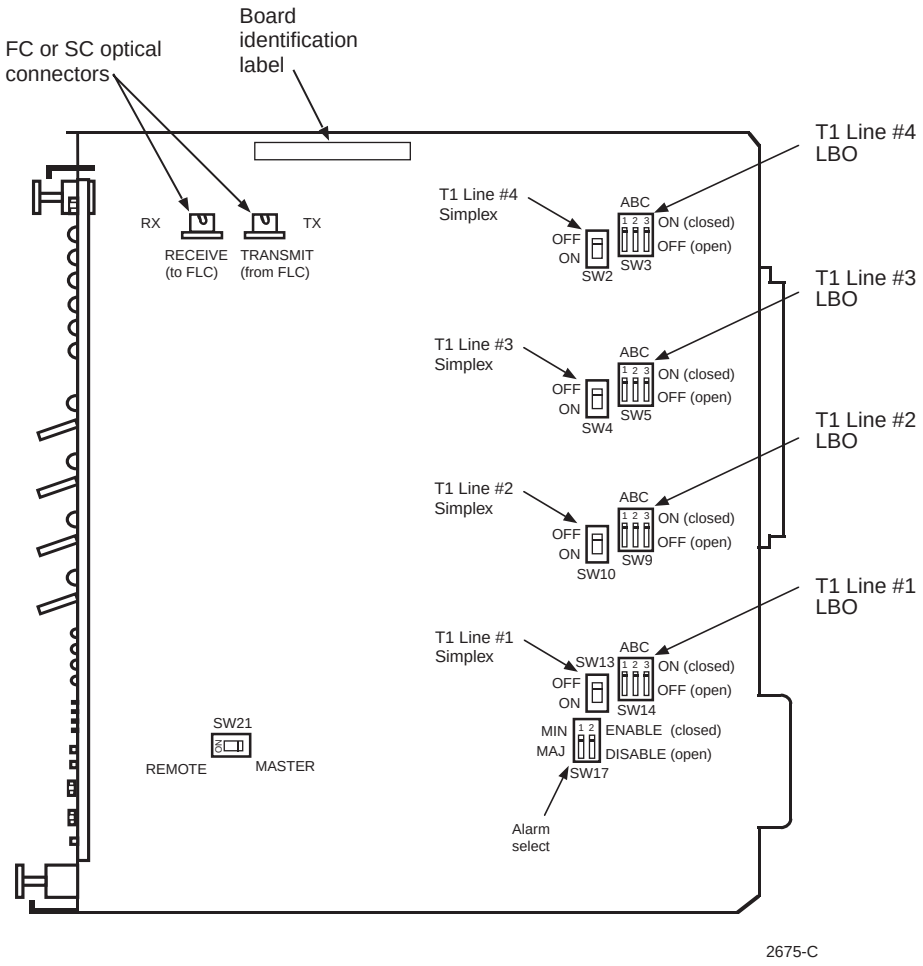


Figure 24. *D3 QFLC*

Table 8. *B2, B3, and D3 Module Switch Positions and Switch Numbers*

Switch Positions			LBO Output Feet (DS1/E1 Output Distance)
A (a)	**B** (a)	**C** (a)	
OFF	ON	ON	0 TO 133
ON	OFF	OFF	133 TO 266
ON	OFF	ON	266 TO 399
ON	ON	OFF	399 TO 533
ON	ON	ON	533 TO 655

Switch Numbers

B2 and B3 Modules	D3 Modules
Switch 2 = Line 4	Switch 3 = Line 4
Switch 4 = Line 3	Switch 5 - Line 3
Switch 15 = Line 2	Switch 9 = Line 2
Switch 18 = Line 1	Switch 14 = Line 1

(a) Switches labeled A, B, and C are on B2, B3, and D3QFLCs.

Table 9. *B2, B3, and D3 Module Switch Positions and Switch Numbers*

Switch Position	Function
ON	60 mA simplex current enabled
OFF	60 mA simplex current disabled

Switch Numbers

B2 and B3 Modules	D3 Module
Switch 3 = Line 4	Switch 2 = Line 4
Switch 5 = Line 3	Switch 4 = Line 3
Switch 11 = Line 2	Switch 10 = Line 2
Switch 19 = Line 1	Switch 13 = Line 1

Table 10. *B2, B3 (Switch 6), and D3 (Switch 21) Module Switch Positions* [(a)]

Switch Position	Function
1 (OFF)	Configure as Module A (master)
1 (ON)	Configure as Module B (remote)
2 (ON/OFF)	Reserved

(a) Each end must be different.

Table 11. *B2, B3 (Switch 8), and D3 (Switch 17) Module Switch Positions*

Switch Positions	Function [(a)]
2 (ON)	Enable Alarms for any incoming DS1/E1 signal failure. (Factory shipped ON.)
2 (OFF)	Disable Alarms for any incoming DS1/E1 signal failure. Includes not sending Remote/HSKP alarm to Far End.
1 (ON)	MINOR LED and Alarm for an incoming DS1/E1 signal or DS1/E1 port failure. (Factory shipped ON.)
1 (OFF)	MAJOR LED and Alarm for an incoming DS1/E1 signal or DS1/E1 port failure.

(a) In order to alarm a DS1/E1 receive port failure, the Minor or Major alarm must be enabled. (It is recommended that the Minor alarm remain enabled as shipped from the factory.)

Table 12. *Front-Panel Switches*

Switch and/or Pushbutton	Position	Function
AMI/B8ZS [(a)] (locking switch up to operate A2)	AMI – left position (B2, B3 and D3)	AMI enabled (Alternate Mark Inversion T1/E1 line format).
	B8ZS – right position (B2, B3 and D3)	B8ZS enabled (bipolar eight zero substitution T1/E1 line format).
RLB/UNEQPT	CENTER NORMAL, UP RLB	T1/E1 line port is in service. If RLB is set while pressing the ENABLE pushbutton, will loop back the associated Far End DS1/E1 line.
RLB/NORMAL/UNEQPT [(a)]	UNEQPT	T1/E1 line port is not in service.

Continued

Table 12. *Front-Panel Switches (Continued)*

Switch and/or Pushbutton	Position	Function
BER >10–r PROT SW [(a)]	10–4 to 10–10	Selects BER threshold for APS if BER on optical link exceeds level set. Selection of unused position causes 10^{-4} default APS.
BER >10–n MIN ALM [(b)]	10–6 to 10–10	Selects BER threshold for Minor alarm if BER on optical link exceeds level set. Selection of unused position disables feature.
LMPTST/FORCE SW [(c)]	Pressed	Lights all front-panel LEDs. If pressed with ENABLE pushbutton, forces transfer of service from the Working to Protect System. If pressed with ENABLE a second time, clears manual lock-in or APS lockout. In B3 and D3 systems, used with RMT ALM DISPLAY to provide configuration matching. In D3 QFLC systems, used in conjunction with the RMT/ALM DISPLAY pushbutton to RESET the D3 QFLC optically connected to it.
RMT ALM DISPLAY	Pressed	Upon receipt of Remote alarm, forces Near End duplicate of Far End module LED status. In B3 and D3 systems, used with LMPTST/FORCE SW to provide configuration matching. In a D3 QFLC system, used in conjunction with the LMPTST/FORCE SW pushbutton to RESET the D3 QFLC optically connected to it.
RESET	Pressed	Resets controller. Clears Remote Loopback, APS lockout and FORCE SW conditions. Pressed whenever AMI/B8ZS, BER thresholds, or NORMAL/UNEQPT switches are changed.

(a) The AMI/B8ZS, RLB/NORMAL/UNEQPT, and BER PROT SW switch positions are compared and must be set in the same position at both ends. The BER PROT SW POSITION Working to Protect System are not compared and, therefore, need not be set the same position at both ends. The BER MIN ALM switch positions are not compared and may be set at different levels on each module.

(b) If threshold is set to an error rate greater than BER PROT SW threshold setting, the system performs a protection switch before a Minor alarm is declared if the systems' optical error rate degrades. (Factory shipped, BER PROT SW is 10^{-6} BER; BER MIN ALM is 10^{-8} BER.)

(c) In an optical system where B3 and/or D3 QFLC modules are used at both ends Working and Protect System (if installed) links, all modules can be configured by first setting the configuration of a Near End module, then while pressing and holding the LMPTST/FORCE SW pushbutton, momentarily press the RMT ALM DISPLAY pushbutton. The other modules in the system match their configuration to the Near End module.

The FLC module reads the switch position during initialization and power-up, but when any switch changes are made on Working modules, the RESET pushbutton at both ends must always be pressed after a selection is completed.

When a B2, B3, or D3 version QFLC is connected into a system that utilizes one or more of the previous models, the performance of the system reverts to the level supported by the earlier version. BER threshold detection and switch will not operate unless B2, B3 and/or D3 modules are on both ends of an optic link.

INSTALLATION

Warning: Do not look into the ends of any optical fiber. Exposure to invisible laser radiation may result.

1 Slide the module into the mounting position, leaving it 5 inches out in front of the chassis. (If QFLCs share a chassis with DS3 FLCs, place the FLCs to the left of the QFLCs for FCC EMI compliance.)

2 Remove the protective covers from the module optics and fiber connectors.

3 Connect the fibers to the module (see Figure 25 on page 44 for connector location).

QFLCs placed in odd- or even-numbered mounting positions should be optically connected to remote QFLCs in odd- or even-numbered mounting positions, respectively.

4 Carefully slide the module into the mounting position taking care that the fiber does not kink or bend.

5 Secure the module with the captive screws.

6 Connect DS1/E1 lines at both ends of the optical link. See "Appendix B - Storing Fiber on Spools" on page 82.

Configuration Switch Settings

The controller in the QFLC module reads the switches during an initialization after power-up or after the RESET pushbutton is pressed.The following configuration switches must be configured identically at both ends:

- AMI/B8ZS (two-position toggle switch)
- RLB UNEQPT or RLB/NORMAL/UNEQPT (three-position toggle switch associated with each DS1/E1 line)
- BER PROT SW
- BER MIN ALM

Automatic Configuration Matching (B3 and D3 QFLC only)

If B3 or D3 QFLC modules are used exclusively at both ends of a Protect or Unprotect System, the system can be automatically configured by setting the Equip, AMI/B8ZS, BER PROT SW, and BER MIN ALM switches on a Near End module by pressing the LMPTST/FORCE SW pushbutton and momentarily pressing the RMT ALM DISPLAY pushbutton. The other B3 or D3 QFLC modules in the system then match their configurations to the Near End module.

The configuration matching feature is not enabled if any QFLC in the Working or Protect System optical link is not a B3 or D3.

Configuration Mismatch Indicators

- After the module is powered up, a self-test failure has occurred if the MOD FAIL LED and Major alarm display red. If this occurs, replace the module.
- The QFLC modules contain the following required for transport:
  - DS1/E1 line interfaces
  - fiber-optic interfaces
  - optic link
  - bit error monitoring circuitry
  - multiplexer/demultiplexer
  - controller
  - power converter

  User-configurable option switches are provided on each module to tailor the system for each individual installation (DS1/E1 lines in- and out-of-service, DS1/E1 line code select, and BER protection switch

threshold). The onboard controllers compare end-to-end settings (protected/unprotect select, master/remote module select, and odd/even slot positions in protected configuration systems) and indicate any inconsistent or mismatched options. The mismatch indications for Quad B2, B3, and D3 versions are shown in Table 13.

Table 13. *Option Selection Mismatch Indications*

	B2, B3, and D3 System Configurations [a]	
Condition	**Protect**	**Unprotect**
NORMAL/UNEQPT end-to-end mismatch	Blink individually. DSI LED Green	Blink individually. DSI LED Green
NORMAL/UNEQPT work-to-protect mismatch	Minor alarm. No blink.	Not Applicable
AMI/B8ZS line code end-to-end mismatch	Blink individually. Line code LED	Blink individually. Line code LED
AMI/B8ZS line code work-to-protect mismatch	Minor alarm. No blink.	Not Applicable
BER PROT SW [b] end-to-end mismatch	Blink RMT/BER LED Yellow	Blink RMT/BER LED Yellow
PROTECT/UNPROTECT end-to-end mismatch	Blink RMT ALM Yellow	Blink RMT ALM Yellow
MASTER/REMOTE end-to-end (not opposite)	Blink RMT ALM Yellow	Blink RMT ALM Yellow
MASTER/REMOTE work-to-protect mismatch	Minor alarm. No blink.	Not Applicable
Odd-/EVEN slot position end-to-end mismatch	Blink RMT ALM Yellow	Not Applicable

(a) If a system has only B3 and D3 QFLC modules, the only mismatches possible are PROTECT/UNPROTECT end-to-end or ODD/EVEN due to crossed fiber cables. The mismatches are indicated by a blinking Yellow RMT ALM LED. If an earlier version QFLC module is installed in a system with all B3 or D3 modules, the modules revert to B2 level operation. When this occurs, the configuration switches are red for each module and mismatches occur as shown in Table 13.

(b) BER PROT SW thresholds on Working and Protect Systems may be set differently (no mismatch possible), but end-to-end must match. BER MIN ALM threshold select switch may be set to different positions on each module.

Operation

QFLC operation consists of alarms, Protect System switching, loopback operation, and in-service AMI/B8ZS and DS1/E1 line changes (see Table 14).

Table 14. *Alarm Table*

	Alarm and LED Status		
Alarm Condition [a]	**Protect System**	**Unprotect System**	**Remarks**
Loss of DS1/E1 line on both Working and Protect Systems	LOS/LPBK (Red) MINOR (Yellow) Minor or MAJOR (Red) Major alarm	LOS/LPBK (Red) MINOR (Yellow) Minor or MAJOR (Red) Major alarm	In order to provide an alarm on a DS1/E1 receiver failure, it is recommended that option Switch 8, positions 1 and 2, be set to the ON position to provide a MINOR Yellow LED and a Minor alarm. However, Switch 8 may also be set to the MAJOR (MAJ) position to provide a MAJOR LED and MAJ alarm. (Does not transfer to Protect System.)
DS1/E1 line receiver failure (DS1/E1 line signal is present on either Working or Protect System.)	LOS/LPBK (Red) MINOR (Yellow) Minor or MAJOR (Red) Major alarm		If DS1/E1 receiver failure is on Working System, service transfers to Protect System. Alarm activation is shown above. DS1/E1 receiver failure is not detected in an unprotected system configuration.
Loss of DS1/E1 output	MOD FAIL (Red) MAJOR (Red) Major alarm	MAJOR (Red) Major alarm	If DS1/E1 output failure is on Working System, service transfers to Protect System.

Continued

Table 14. *Alarm Table (Continued)*

Alarm Condition [a]	Alarm and LED Status		Remarks
	Protect System	Unprotect System	
Loss of optical input signal	OPTLOS/OOF (Yellow) MINOR (Yellow) Minor alarm	OPTLOS/OFF (Yellow) MAJOR (Red) Major alarm	
DS2 signal out-of-frame	OPTLOS/OOF (Red) MINOR (Yellow) Minor alarm	OPTLOS/OFF (Red) MAJOR (Red) Major alarm	Indicates module receiving faulty optical signal.
BER PROT SW [b] (threshold exceeded)	BER/MOD FAIL (Yellow) MINOR (Yellow) Minor alarm	BER/MOD FAIL (Yellow) MAJOR (Red) Major alarm	Optical link exceeded BER APS threshold level.
BER MIN ALM [b] (threshold exceeded)	BER/MOD FAIL (Yellow) MINOR (Yellow) Minor alarm	BER/MOD FAIL (Yellow) MINOR (Yellow) Minor alarm	Optical link exceeded BER Minor alarm threshold level.
Laser degrade	MOD FAIL (Red) MINOR (Yellow) Minor alarm	MOD FAIL (Red) MINOR (Yellow) Minor alarm	Does not transfer to Protect System.
Controller fails	MOD FAIL (Red) MINOR (Yellow) Minor alarm	MOD FAIL (Red) MAJOR (Red) Major alarm	Does not send Remote alarm signal.
Remote alarm	RMT/HSKP (Yellow) Remote alarm	RMT/HSKP (Yellow) Remote alarm	Indicates Far End major, minor, or Housekeeping alarm. Press RMT ALM DISPLAY pushbutton. Duplicates Far End LED status. RMT/HSKP LED is dark. If Housekeeping alarm, RMT/HSKP LED remains lit.
DS1/E1 line loopback operated	LOS/LPBK (Yellow) MINOR (Yellow) Minor alarm	LOS/LPBK (Yellow) MINOR (Yellow) Minor alarm	
Fuse failure (internal)	MOD FAIL (Red) MINOR (Yellow) Minor alarm	MOD FAIL (Red) MAJOR (Red) Major alarm	No Remote alarm initiated lack of other module indication signified fuse failure.
Power supply degradation	MOD FAIL (Red) MINOR (Yellow) Minor alarm	MOD FAIL (Red) MAJOR (Red) Major alarm	+12V and -5V are outside tolerance limits.
Power feed fails	Minor	Major	
Automatic switch to Protect System	ONLINE/STDBY (Yellow) MINOR (Yellow) Minor alarm ONLINE/STDBY (Green)		(Working System) Service switched to Protect System. (Protect System) Service on Protect System.
APS lockout	APS LKOUT (Red) MINOR (Yellow) Minor alarm		After third APS switch within a 24-hour period.

(a) Alarm relay contacts remain closed for the alarm duration (or at least 20 seconds), except for power failures.

(b) If the optical BER on the standby systems exceeds either the BER MIN ALM or BER PROT SW threshold level, a Minor alarm is declared and BER/MOD FAIL LED lights Yellow. If error rate on both standby and Working Systems exceeds BER PROT SW threshold, since APS is disabled, a Major alarm is declared and BER/MOD FAIL LED lights Yellow.

Force Switch—Working System to Protect System

After Working System trouble is cleared, the service is normally force-switched from Protect to Working. DS1/E1 service automatically switches back if Working System trouble is cleared and Protect System subsequently fails (Table 15 on this page through Table 19 on page 41).

Table 15. *Force Switch—Working to Protect System*

QFLC System	Switch	Normal Result (at both ends)
Protect System	Press LMPTST/FORCE SW pushbutton with ENABLE pushbutton	ONLINE/STDBY LED (Green)—System online. FORCE SW LED (Yellow)—DS1/E1 service force-switched. MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor and Remote alarm relay contacts are closed.
Working System		ONLINE/STDBY LED (Yellow)—System in standby mode.

Table 16. *Force Switch—Protect to Working System*

QFLC System	Switch	Normal Result (at both ends)
1 Working System	Press LMPTST/FORCE SW pushbutton with ENABLE pushbutton	ONLINE/STDBY LED (Green) FORCE SW LED (Yellow) MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor and Remote alarm relay contacts close. ONLINE/STDBY LED (Yellow)—System in standby mode.
2 Working System	Press LMPTST/FORCE SW pushbutton with ENABLE pushbutton a second time	FORCE SW (Dark)—Shows APS feature enabled. MINOR LED (Dark) RMT/HSKP (Dark) Minor and Remote alarm relay contacts open.
Protect System		ONLINE/STDBY LED (Yellow)—System in standby mode.

Table 17. *Lock-In and Release Service on Working System*

QFLC System [(a)]	Switch	Normal Result (at both ends)
Lock-In		
1 Working System	Press LMPTST/FORCE SW pushbutton with ENABLE pushbutton	FORCE SW LED (Yellow)—Indicates APS feature disabled. ONLINE/STDBY LED (Solid Green) MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor and Remote alarm relay contacts close.
Release Lock-In		
2 Working System	Press LMPTST/FORCE SW pushbutton with ENABLE pushbutton	FORCE SW LED (Dark)—Indicates APS feature enabled. ONLINE/STDBY LED (Solid Green) MINOR LED (Dark) RMT/HSKP (Dark) Minor and Remote alarm relay contacts open.

(a) Service on Protect System can be locked in with the same procedure.

Table 18. *Activate and Deactivate Loopback Circuit*

QFLC System	Switch	Normal Result
Activate Loopback		
Near End	Pull out and push up RLB UNEQPT or RLB/NORMAL/UNEQPT switch with ENABLE pushbutton.	LOS/LPBK LED (Yellow) on looped back DS1/E1 line. MINOR LED (Yellow) Minor alarm relay contacts close.
Far End	RMT/HSKP LED (Yellow)	Remote alarm relay closure. DS1/E1 line looped back. AIS sent to drop equipment.
Far End	Press RMT ALM DISPLAY pushbutton	RMT/HSKP LED (Dark). LOS/LPBK LED (Yellow) on looped back DS1/E1 line.
Deactivate Loopback		
Near End	Pull out and push up RLB UNEQPT or RLB/NORMAL/UNEQPT switch with ENABLE pushbutton.	LOS/LPBK LED (Green) Minor LED (Dark). Minor alarm relay contacts open.
Far End		LOS/LPBK LED (Green) Remote alarm relay contacts open. Loopback circuit released.

Table 19. *In-Service Change AMI/B8ZS Format—Protect System*

On Protect System
1 Set front-panel switches at both ends to selected AMI/B8ZS position.
2 Press RESET pushbutton at both ends.
3 Force switch the service from Working System to Protect System.
On Working System
1 Match AMI/B8ZS setting on the Working System at both ends.
2 Press RESET pushbutton at both ends.
3 Release force switch lock-in to transfer service from Protect to Working System.

Table 20 on page 42 provides instructions on adding or removing the DS1/E1 line RLB/UNEQPT or RLB/NORMAL/UNEQPT switch for the following positions:

- Center or NORMAL
- DS1/E1 Port Equipped UNEQPT
- DS1/E1 Port Not Equipped

Table 20. *DS1/E1 Line RLB/UNEQPT or RLB/NORMAL/UNEQPT Switch*

Near End [(a)]
1 Change RLB/UNEQPT or RLB/NORMAL/UNEQPT switch(es) on Working System and Protect System to desired position. **2** Press RESET pushbutton on each module.
Far End [(a)]
1 Change RLB/UNEQPT or RLB/NORMAL/UNEQPT switch(es) on Working and Protect Systems to matching position. **2** Press RESET pushbutton on each module.

(a) LOS/LPBKs blink at both ends. Minor alarm is initiated during switch changes.

Maintenance

Table 21 assumes that the system is properly equipped and has met the requirements for an operating system. Multiple trouble indications may result from a single cause; however, it should be assumed that only one trouble exists. Alarms should be cleared in the following order: Major, Remote, and then Minor.

Table 21. *Trouble Analysis Table—Protect System*

Trouble Indication	Possible Cause	Corrective Action
DS1/E1 LOS LED (Red) (Major or Minor alarm)	Incoming DS1/E1 line or port failure	• If trouble is on both Working and Protect System, clear DS1/E1 line trouble. • If trouble is only on Working or Protect System, replace QFLC module. • If trouble is on an Unprotect System, trouble is with DS1/E1 line.
BER/MOD FAIL LED (Red)	DS1/E1 output failure	Press RESET pushbutton. If not corrected, replace QFLC module.
	Controller or internal fuse failed	Press RESET pushbutton. If not corrected, replace QFLC module.
	Laser degradation	Replace QFLC module (may not cause system failure).
OPT LOS/OOF LED (Red)	Optical incoming signal is out-of-frame	• Check optical incoming signal level. If present, replace QFLC module. • If signal level is low or absent, test Far End module fiber output level. • If signal level is low or absent, replace Far End QFLC module. If level is correct, replace fiber line or clean fiber connectors.
OPT LOS/OOF LED (Yellow)	Loss of optical incoming signal	• Check optical incoming signal level. If present, replace QFLC module. • If signal level is low or absent, test Far End module fiber output level. If signal level is absent, replace Far End QFLC module. If level is correct, replace fiber line.
RMT/HSKP LED (Yellow)	Far End trouble	• Press RMT ALM DISPLAY pushbutton. If RMT/HSKP LED remains Yellow, it indicates Far End Housekeeping alarm. • If RMT/HSKP LED is extinguished, LEDs are illuminated on front panel to indicate Far End trouble condition. • If a DS1/E1 LOS LED is red, operate the DS1/E1 lines Far End loopback. If successful, it indicates Far End DS1/E1 line failure. • If other LEDs listed in the Trouble Indication column illuminate, refer to those items for corrective action.

Continued

Table 21. *Trouble Analysis Table—Protect System (Continued)*

Trouble Indication	Possible Cause	Corrective Action
BER/MOD FAIL (Yellow)	Optical link exceeds Minor alarm BER	In Protect System mode, there should be no APS. Trouble is in Near or Far End QFLC, or in fiber line.
	Optical link exceeds alarm APS BER	In Protect System mode, there is an APS. In Unprotect System mode, a Major threshold is declared. Replace Near End QFLC. If trouble is not cleared, replace Far End QFLC. If problem still exists, replace fiber line.

DS3 FLC MODULE

OPTIONS

Electrostatic Discharge (ESD) protection must always be used while handling circuit cards. An ESD grounding jack or ESD wrist strap is provided in each mounting chassis.

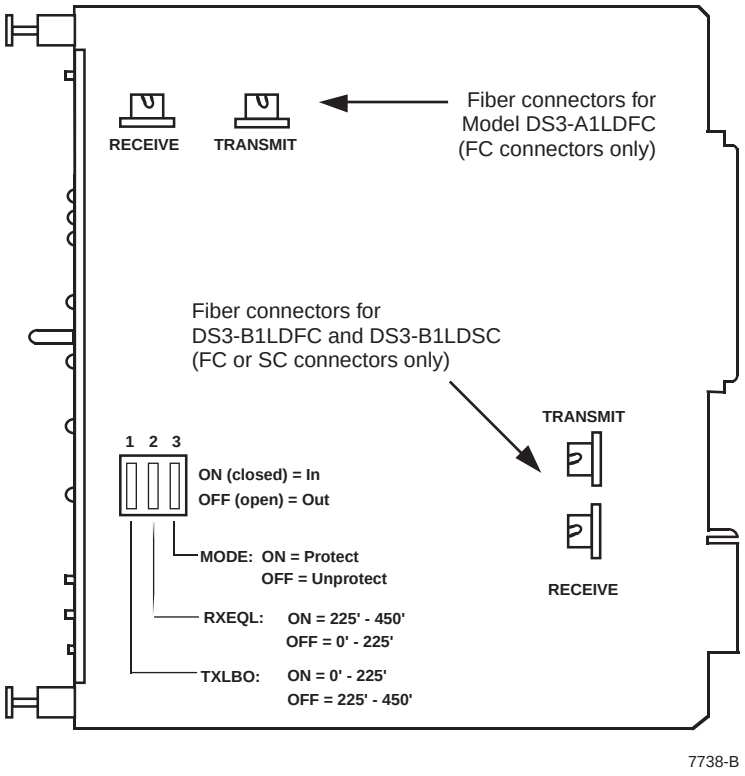


Figure 25. *DS3 FLC Option Switch Panel*

Table 22. *DS3 FLC Switches*

Switch	Function
Switch 1 (TXLBO)	Transmit Line Buildout (LBO)
ON	DS3 output signal range of 0 to 225 ft.
OFF	DS3 output signal range of 225 ft. to 450 ft.
Switch 2 (RXEQL)	Receive Equalizer (EQL)
ON	DS3 input signal range of 225 ft. to 450 ft.
OFF	DS3 input signal range of 0 to 225 ft.
Switch 3 (MODE)	Protect/Unprotect Modes
ON	Protect mode
OFF	Unprotect mode

FRONT PANEL

Figure 26 shows the DS3 FLC front panel. Table 23 on page 46 describes the front-panel controls and indicators.

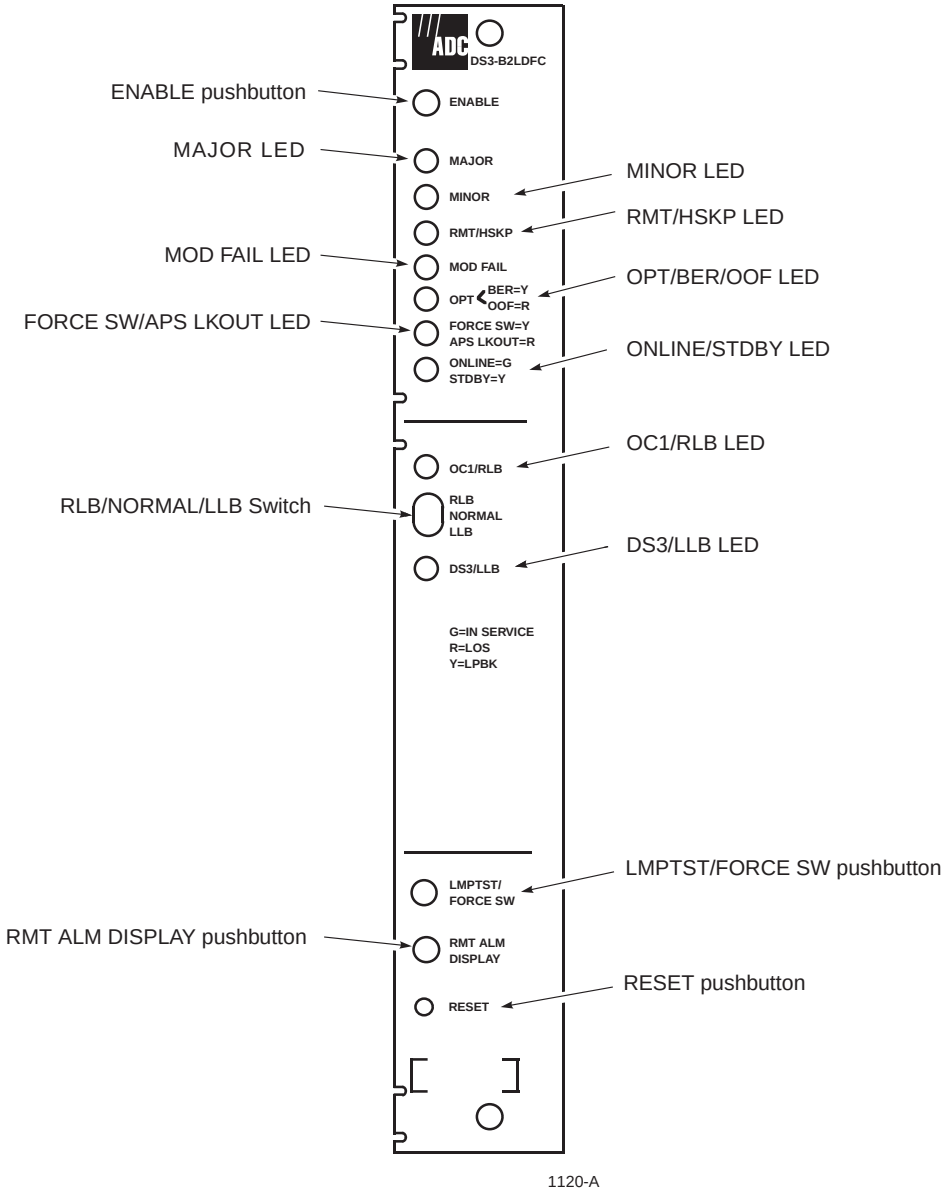


Figure 26. *DS3 FLC Front Panel*

Table 23. *Front-Panel Description*

Front-Panel Feature	Function
PUSHBUTTONS	
ENABLE	Must be pressed simultaneously with either the LMPTST/FORCE SW pushbutton or RLB/NORMAL/LLB switch to enable the applicable function.
RMT ALM DISPLAY	Remote alarm Display Pushbutton—Duplicates the LED status of the Far End FLC module and extinguishes the RMT/HSKP LED. (Exception is a Far End HSKP alarm which keeps the RMT/HSKP LED illuminated yellow.)
LMPTST/FORCE SW	Lamp Test Force Pushbutton—Lights all front-panel LEDS for testing purposes. In 1 + 1 Protect System mode, if pressed in conjunction with the ENABLE pushbutton, manually switches the service; if pressed in conjunction with the ENABLE pushbutton a second time, clears the manual lock-in or APS lock-out condition.
RESET	Reset Pushbutton—When momentarily pressed, performs the following tasks, leaving present on-line module in service: • Full reset of the controller, a diagnostic, and other control logic • Clears loopback mode • Clears FORCE SW or APS LKOUT modes (Does not affect DS3 service unless pushbutton is pressed longer than 3 seconds.)
SWITCH	
RLB/NORMAL/LLB	Remote Loopback/Normal/Local Loopback three-position switch. • RLB position (with ENABLE switch pressed)—Remote loopback circuit is operating. • LLB position (with ENABLE switch pressed)—Local loopback circuit is operating. Loopback circuits are released by repeating this procedure or by depressing the RESET pushbutton. • NORMAL position—Indicates in-service condition.
LEDs	
MAJOR	Major Alarm LED—Red. (Normal state is off.)
MOD FAIL	Module Fail LED—Red. Failed conditions are field-replaceable fuse failure, controller failure, DS3 output failure, or other module problems diagnosed by the controller. (Normal state is off.)
FORCE SW/APS LKOUT	Force Switch or Automatic Protection Switch LockOut—Indicates 1 + 1 Protection system status. (Normal state is OFF.) • Yellow—DS3 service is force-switched or locked in. • Red—Automatic Protection Switch feature is locked out because three switches have occurred within a 24-hour period. (Either color indicates the automatic protection feature is disabled.)
MINOR	Minor Alarm LED—Yellow. (Normal state is OFF.)
RMT/HSKP	Remote or Housekeeping alarm LED—Yellow from Far End Major, Minor, or Housekeeping alarm. (Normal state is OFF.)
OPT/BER/OOF	Optical status bicolor LED • Red—Optical Out-of-Frame condition. • Yellow—Bit Error Rate is greater than or equal to threshold.
ONLINE/STDBY	Online/Standby bicolor LED • Green—DS3 system is in service. • Yellow—DS3 is in standby (Protect) mode.

Continued

Table 23. *Front-Panel Description (Continued)*

Front-Panel Feature	Function
LEDs (Continued)	
OC1/RLB	Optical Carrier 1/Remote Loopback tricolor LED • Yellow—Remote loopback is operation. • Red—Indicates Optical Loss-of-Signal. • Green—Operating normally.
DS3/LLB	DS3 Local Loopback tricolor LED • Yellow—Local loopback is operating. • Red—Indicates loss of incoming DS3 signal. • Green—Operating normally.

INSTALLATION

The DS3 FLC mounts only in the following:

- DS3 FLC Two-Position Horizontal Mounting Shelf
- FLC Four-Position Universal Wall Mount Cabinet with DS3 Adapter Kit FWM-DS3KIT-4
- FLC Eight-Position Universal Mounting Shelf with either of the following kits:
  - DS3 Adapter Kit FRM-DS3KIT-8
  - Unprotected DS3 Adapter Kit FRM-DS3KIT-8UNP

DS3 FLCs placed in odd or even chassis slots must be optically connected to remote DS3 FLCs in odd or even slots, respectively. If DS3 FLCs share a chassis with QFLCs, they should be placed to the left of the QFLCs for FCC EMI compliance.

DS3 Two-Position Horizontal Mounting Shelf

One protected or one unprotected DS3 FLC system may reside in the shelf. In the protected configuration, the Working module normally resides in the lower slot (slot 1), with the protected module in the upper slot (slot 2). In an unprotected configuration, the DS3 FLC must reside in the lower slot with the upper slot vacant and must be optically connected to an FLC residing in an odd- numbered slot.

Four-Position Universal Wall Mounting Cabinet

Two protected or unprotected (or a combination of each) DS3 systems may reside in the four positions of the shelf. In the protected configuration, the Working DS3 FLC modules occupy slots 1 and 3, and their paired protected modules fill slots 2 and 4, respectively. In the unprotected configuration DS3 FLCs may occupy slots 1 or 3 with the accompanying slot (2 or 4, respectively) vacant.

Eight-Position Universal Mounting Shelf

At the most, four protected or eight unprotected DS3 systems may reside in the Eight-Position Universal Mounting Shelf. In a protected configuration when the Protect DS3 Adapter Kit is used, the Working System DS3 FLC modules occupy slots 1, 3, 5, or 7, paired to the Protect System modules in slots 2, 4, 6, or 8, respectively. In the unprotected configuration, DS3 FLCs must occupy the odd slot of each slot pair (1–2, 3–4, 5–6, 7–8). When using the Unprotected DS3 Adapter Kit, DS3 FLCs may occupy any slot.

Do not look into the ends of any optical fiber. Exposure to invisible laser radiation may result.

To install the DS3 module in a Four- or Eight-Position chassis, perform the following:

1. Ensure backplane is correctly set. (See "FLC Module Features" on page 31.)
2. Configure TXLBO and RXLBO switches.
3. Slide the module into the slot until the fiber connectors are at about 3 inches from the front of the chassis.
4. Remove the protective covers from the module and fiber connectors.
5. Clean the fiber patch cord and connectors. (Refer to "Appendix D - Optical Fiber Systems Cleaning and Mating Instructions" on page 85.)
6. Connect the fibers to the module. (See Figure 25 on page 44.)
7. Carefully slide the module into the chassis making sure the fiber does not kink or bend.
8. Secure the module to the chassis with the captive screws.

Acceptance Tests

Before acceptance tests begin, the fiber network and DS3 lines at both ends must be connected. The ONLINE, RLB, and DS3/LLB LEDs on the Working System should illuminate Green. The STANDBY LED on the Protect System should also illuminate Green to show both systems are up and working.

Option and module installation errors are present if the following occurs:

- Blinking DS3/LLB LED—Receive EQL or LBO in Working Systems are mismatched, or protected module is installed when the PROT option not selected.
- Blinking RMT/HSKP—Transmit and receive pair of fiber-optic connections to Working and Protect Systems criss-crossed or PROT option mismatched.

Installation Test Guide

The Test Guide (Table 24) is intended as an aid in localizing installation trouble. The applicable tests should be made from both ends.

Table 24. *Test Guide*

Test	Action	Verification
	Near End and Far End (both ends)	
1 Verify front-panel LEDs light.	Press LMPTST/FORCE SW pushbutton.	**Front-panel LEDs light as follows:** MAJOR (Red) MINOR (Yellow) RMT/HSKP (Yellow) MOD FAIL (Red) OPT OOF/BER (Yellow) APS LKOUT/FORCE SW (Yellow) ONLINE/STDBY (Yellow) RLB (Yellow) DS3/LLB (Yellow)

Continued

Table 24. *Test Guide (Continued)*

Test	Action	Verification
2 Verify loss of DS3 input signal.	**Near End Module** Open incoming DS3 signal coaxial connector at the chassis DS3 panel. Restore after test.	DS3/LLB LED (Red)—Indicates loss of incoming DS3 signal. MAJOR LED (Red) Major alarm relay closes. RLB LED (Green) (A DS3 AIS is transmitted to Far End module.) **Far End module displays as follows:** RMT/HSKP LED (Yellow) Remote alarm relay closes.
	Far End Module Press RMT ALM DISPLAY pushbutton.	RMT/HSKP LED (Dark) DS3/LLB LED (Red)—Indicates the Far End lost its incoming DS3 signal. MAJOR LED (Red) RLB LED (Green)
3 Operate Local Loopback. (See Step 5 in this table to release loopback.)	**Near End Module** Place RLB NORMAL LLB switch in LLB position and simultaneously press ENABLE pushbutton (RLB NORMAL LLB switch returns to NORMAL setting.)	DS3/LLB LED (Yellow)—Indicates loopback operated. MINOR LED (Yellow) Minor alarm—Relay closes. RLB LED (Green) (Local DS3 signal is looped back and a DS3 AIS is transmitted to the remote end. **Far End module displays as follows:** RMT/HSKP LED (Yellow) Remote alarm relay closes.
	Far End Module Press RMT ALM DISPLAY pushbutton at the remote end.	RMT/HSKP LED (dark). DS3/LLB LED (Yellow)—indicates Far End module is in loopback condition. MINOR LED (Yellow) RLB LED (Green)
4 Operate Remote Loopback. (See Step 5 in this table to release loopback.)	**Near End Module** Place RLB NORMAL LLB switch in RLB position.	RLB LED (Yellow)—Indicates loopback operated. **Far End module displays as follows:** RMT/HSKP LED (Yellow) Remote alarm relay closes. (DS3 signal is looped back in both directions.)
	Far End Module Press RMT ALM DISPLAY pushbutton at the remote end.	RMT/HSKP LED (Dark) RLB (Yellow)—Shows module is in loopback. MINOR LED (Yellow) DS3/LLB LED (Green)

Continued

Table 24. *Test Guide (Continued)*

Test	Action	Verification
	Near End Module	
5 Release Local (LLB) or Remote (RLB) Loopback.	Place RLB NORMAL LLB in LLB or RLB position and simultaneously press ENABLE pushbutton.	RLB LED (Green) if remote loopback released and DS3 service normal (DS3/LLB LED is Green). DS3/LLB LED (Green) if local loopback released and DS3 service normal. RLB LED (Green) MINOR LED (dark) Minor alarm relay contacts open. **Far End module displays as follows:** RLB LED (Green) if remote loopback released and DS3 service normal. DS3/LLB LED (Green) REMOTE LED (dark) Remote alarm relay contacts open. DS3/LLB LED (Green) if local loopback released and DS3 service normal. RLB LED (Green) REMOTE LED (Dark) Remote alarm relay contacts open.
	Working System Module	
6 Automatic Protection Switch (APS) Working.	Partially remove the Working System module until it is disconnected from the chassis connector.	ONLINE LED (Green)—indicates Protect System is providing DS3 service. When the FLC is unplugged, all LEDs are dark. RLB LED (Green) DS3/LLB LED (Green) MINOR LED (Yellow) Minor alarm relay closes. (Far End shows Remote alarm on Protect; Minor and LOS on Working.)
	Reseat the Working System module.	DS3/LLB LED (Green) RLB LED (Green) (Above function is also present at the Far End.) **Protect System module displays as follows:** ONLINE LED (Green) indicates Protect System is providing DS3 service. RLB LED (Green) DS3 LLB LED (Green) MINOR LED (Dark) Minor alarm relay opens.

Continued

Table 24. *Test Guide (Continued)*

Test	Action	Verification
	Working System Module	
7 Force switch Protect System to Working System.	Press LMPTST/FORCE SW pushbutton and simultaneously press ENABLE pushbutton.	ONLINE LED (Green) to show its providing the DS3 service. RLB LED (Green) DS3/LLB LED (Green) FORCE SW LED (Yellow) indicates DS3 service was force-switched and APS feature is disabled. MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor and Remote alarm relays close. (LEDs and alarms listed above are present at both ends of the Working System.) **Protect System module displays as follows:** STDBY LED (Yellow) shows Protect System is in standby mode. RLB LED (Green) (LEDs listed above are present at both ends of the Protect System.)
	Press the LMPTST FORCE SW pushbutton simultaneously with the ENABLE pushbutton a second time.	FORCE SW LED (dark) indicates APS feature is enabled. MINOR AND RMT/HSKP LEDs (dark). Minor and Remote alarm relay contacts open. (Above LEDs and alarms are extinguished at both ends of the Working System.)
	Far End Module	
8 Test Remote alarm through a Housekeeping alarm test.	At Far End, place a short across a pair of Housekeeping alarm leads. Remove short after test.	RMT/HSKP LED (Yellow)—Indicates Remote alarm. Remote alarm relay closes.
	Near End Module	
	At Near End, press RMT ALM DISPLAY pushbutton.	RMT/HSKP LED (Yellow)—Indicates a Far End Housekeeping alarm.

OPERATION

This section includes normal status indications, definitions of alarms indications, Automatic Protection Switch indications, force switch and lock-in operation, and loopback procedures.

Table 25. *Normal System Operating Mode*

System	LED Status	Result
Working System	ONLINE (Green)	System is providing DS3 service.
	RLB (Green)	Optic signal—operating normally.
	DS3/LLB (Green)	DS3 signal—operating normally.
Protect System	STDBY (Yellow)	System is in standby mode.
	RLB (Green)	Optic signal—operating normally.
	DS3/LLB (Green)	DS3 signal—operating normally.

System Alarms

A Near End Major, Minor or Housekeeping alarm signal is received at the Far End as a Remote alarm.

Table 26. *Protect System Alarms*

Alarm Condition [(a)]	LED Status	Alarm	Remarks
Loss of DS3 input signal	DS3/LLB (Red) MINOR (Yellow)	Minor	Alarm relay closes. (Does not operate APS feature. An AIS is transmitted to Far End module.)
Loss of DS3 output signal (DS3 input signal is present at Far End.)	MOD FAIL (Red) MINOR (Yellow)	Minor	Alarm relay closes.
Optical loss-of-signal	RLB (Red) MINOR (Yellow)	Minor	Alarm relay closes.
Optical out-of-frame (Module receives faulty signal and is unable to frame on it.)	OPT-OOF (Red) MINOR (Yellow)	Minor	Alarm relay closes.
Optical Bit Error Rate (Equal to or greater than threshold.)	OPT-BER (Yellow) MINOR (Yellow)	Minor	Alarm relay closes.
Internal fuse failure, Controller failure, or DC Power Supply output voltages low	MOD FAIL (Red) MAJOR (Red)	Major	Alarm relay closes. (Does not send a Remote alarm signal; Far End RLB is Red.)
Laser degradation	MOD FAIL (Red) MINOR (Yellow)	Minor	Alarm relay closes. (Does not operate APS feature.)
Remote alarm	RMT/HSKP (Yellow)	Remote	Alarm relay closes. To determine alarm, press RMT ALM DISPLAY pushbutton to display Far End module alarm status on Near End front-panel LEDs. If Far End Housekeeping alarm condition is present, RMT/HSKP LED remains illuminated (Yellow); otherwise it is extinguished.
Automatic Protection Switch (APS) to Protect System (LEDs and alarms activated at both ends.)	STDBY (Yellow) MINOR (Yellow) ONLINE (Green)	Minor	Alarm relay closes. (Cause of Automatic Protection Switch activates appropriate alarms as described in this table.) On Protect System.
Working System and Protect System in Minor alarm condition	MAJOR (Red)	Major	Alarm relay closes. (APS feature disabled.)
Both -48 Vdc power supplies fail		Major Minor	Alarm relay closes. (APS feature disabled.)

(a) When an alarm relay is activated, the alarm relay contacts close and remain closed during the alarm condition or for 20 seconds, whichever is longer. A controller, fuse, or power supply failure does not extend the alarm duration.

Table 27. *Unprotect System Alarms*

Alarm Condition [a]	LED Status	Alarm	Remarks
Loss of DS3 Input signal	DS3/LLB (Red) MAJOR (Red)	Major	Alarm relay closes. (An AIS is sent to Far End module.)
Loss of DS3 Output signal	MOD FAIL (Red) MAJOR (Red)	Major	Alarm relay closes.
Loss of optical signal	RLB (Red)	Major	Alarm relay closes.
Optical out-of-frame (Indicates module is receiving a faulty signal and is unable to frame on it.)	OPT-OOF (Red) MAJOR (Red)	Major	Alarm relay closes.
Optical Bit Error Rate (Equal to or greater than threshold.)	OPT-BER (Yellow) MAJOR (Red)	Major	Alarm relay closes.
Internal fuse failure, controller failure, or DC/DC converter output voltage low	MOD FAIL (Red) MAJOR (Red)	Major	Alarm relay closes. (Does not send a Remote alarm signal. Far End RLB (Red).
Laser degradation	MOD FAIL (Red) MINOR (Yellow)	Minor	Alarm relay closes.
Remote alarm	RMT/HSKP MINOR (Yellow)	Remote	Alarm relay closes. (To determine alarm, press RMT ALM DISPLAY pushbutton to display Far End LED alarm status on the Near End front-panel LEDs.) If Far End Housekeeping alarm condition is present, RMT/HSKP remains illuminated (Yellow); otherwise it is extinguished.
Both -48 Vdc power feeds fail		Major Minor	Alarm relay closes.

(a) When an alarm relay is activated, the alarm relay contacts close and remain closed during the alarm condition or for 20 seconds, whichever is longer. A controller, fuse, or power supply failure does not extend the alarm duration.

Table 28. *Automatic Protection Switch—Working to Protect System*

DS3 FLC System	LED Status	Result
Protect System [a] (both ends)	ONLINE LED (Green)	Indicates DS3 service is on Protect System.
	RLB LED (Green)	Optic signal okay.
	DS3/LLB LED (Green)	DS3 signal okay.
Working System [b]	STDBY LED (Yellow)—both ends	Indicates service not on system and is in a standby mode.
	MINOR LED (Yellow)—at end with outage	Minor alarm relay closes.
	RLB LED (Green) (Red)	 Optic signal okay. If the optical signal is lost.
	DS3/LLB LED (Green) (Red)	 DS3 signal okay. If DS3 signal is lost.
	REMOTE LED (Yellow)—at Far End from outage	Remote alarm relay closes.

(a) Refer to Table 26 on page 52 for trouble indication that may have caused the Working System to switch.
(b) After the Working System trouble is cleared, DS3 service is normally force-switched back to the Working System. However, the service automatically switches back if the Working System trouble is cleared and the Protect System subsequently fails.

Table 29. *Force Switch—Working to Protect System*

DS3 FLC System	Switch Operation	Result
Protect System	Press LMPTST/FORCE SW pushbutton and simultaneously press the ENABLE pushbutton.	ONLINE LED (Green)—Indicates it is providing DS3 service RLB LED (Green)—Optical signal okay. DS3 LLB LED (Green)—DS3 signal okay. FORCE SW LED (Yellow)—Indicates service was force-switched and Automatic Protection Switch (APS) is disabled. MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor alarm relay closes. Remote alarm relay closes. (LED and alarms listed above are present at both ends of the Protect System.)
Working System		STDBY LED (Yellow)—Indicates Working System is in a standby mode. RLB LED (Green) DS3/LLB LED (Green) LEDs listed above are present at both ends of the Working System.

Table 30. *Force Switch—Protect to Working System*

DS3 FLC System	Switch Operation	Result
Working System	Press LMPTST/FORCE SW pushbutton and simultaneously press the ENABLE pushbutton.	ONLINE LED (Green)—Indicates it is providing DS3 service. RLB LED (Green)—Optic signal okay. DS3 LLB LED (Green)—DS3 signal okay. FORCE SW LED (Yellow)—Indicates DS3 service was force-switched and APS feature is disabled. MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor alarm relay closes. Remote alarm relay closes. (LED and alarms listed above are present at both ends of the Working System.
Protect System		STDBY LED (Yellow)—Indicates Protect System is in a standby mode. RLB LED (Green) DS3/LLB LED (Green) (LEDs listed above are present at both ends of the Protect System.)

Continued

Table 30. *Force Switch—Protect to Working System (Continued)*

DS3 FLC System	Switch Operation	Result
Working System	Press LMPTST/FORCE SW pushbutton and simultaneously press the ENABLE pushbutton a second time.	FORCE SW LED (extinguished) indicates APS feature is enabled. MINOR LED (extinguished). RMT/HSKP LED (extinguished). Minor alarm relay contacts open. Remote alarm relay contacts open. (LEDs and alarms listed above are present at both ends of the Working System.)

Table 31. *Lock-In and Release Working System* [(a)]

Switch	Result
LOCK-IN PROCEDURE	
Press LMPTST/FORCE SW pushbutton simultaneously with ENABLE pushbutton.	ONLINE LED (Green) RLB LED (Green) DS3/LLB LED (Green) ONLINE LED (Green) FORCE SW LED (Yellow) Indicates APS feature disabled. MINOR LED (Yellow) RMT/HSKP LED (Yellow) Minor alarm relay closes. Remote alarm relay closes. (LEDs and alarms listed above are present at both ends of the Working System.)
RELEASE PROCEDURE	
Press LMPTST/FORCE SW pushbutton simultaneously with ENABLE pushbutton.	ONLINE LED (Green) RLB LED (Green) DS3/LLB LED (Green) FORCE SW LED (extinguished) indicating APS feature enabled. MINOR, and RMT/HSKP LEDs (extinguished). Minor and Remote alarm relay contacts open. LEDs and alarms listed above are present at both ends of the Working System.

(a) DS3 service on the Protect System can be locked in and released with the same procedure.

Table 32. *Activate and Release Local Loopback (Activate Loopback)*

Terminal	Switch	Result
Local End	Place RLB NORMAL LLB switch in the LLB position while simultaneously pressing the ENABLE pushbutton.	DS3/LLB LED (Yellow)—Shows local loopback operated. MINOR LED (Yellow) Minor alarm relay closes. RLB LED (Green) (Local DS3 signal is looped back and a DS3 AIS is transmitted to the remote end.)
Remote End	 Press RMT ALM DISPLAY pushbutton.	RMT/HSKP LED (Yellow) Remote alarm relay closes. DS3/LLB LED (Green) RLB LED (Green) DS3/LLB LED (Yellow) indicates Far End module in local loopback mode. RMT/HSKP LED (extinguished). RLB LED (Green)

Table 33. *Activate and Release Local Loopback (Release Loopback)* [(a)]

Terminal	Switch	Result
Local End	Place RLB NORMAL LLB switch in the LLB position while simultaneously pressing the ENABLE pushbutton.	DS3/LLB LED (Green)—Indicates loopback released and normal service restored. MINOR LED—Extinguished. Minor alarm contacts open. RLB LED (Green)
Remote End	(If RMT ALM DISPLAY pushbutton was operated)	DS3/LLB LED (Green) RLB LED (Green) Remote alarm relay contacts open. (If RMT ALM DISPLAY pushbutton was not operated.) RMT/HSKP LED—Extinguished. DS3/LLB LED (Green) RLB LED (Green) Remote alarm relay contacts open.

(a) APS feature is disabled while the system is in a loopback mode. Any operated loopback circuit is automatically cleared before a new loopback is set up.

Table 34. *Activate and Release Remote Loopback (Activate Loopback)*

Terminal	Switch	Result
Local End	Operate RLB NORMAL LLB switch to the RLB position while simultaneously pressing the ENABLE pushbutton.	RLB LED (Yellow)—Shows remote loopback operated. MINOR LED (Yellow) Minor alarm relay closes. (DS3 signal is looped back in both directions at the remote end.)
Remote End	 Press RMT ALM DISPLAY pushbutton.	RMT/HSKP LED (Yellow) Remote alarm relay closes. RLB LED (Green) DS3/LLB LED (Green) RLB LED (Yellow)—Shows module's remote loopback circuit is operated. RMT/HSKP LED—Extinguished DS3/RLB LED (Green)

Table 35. *Activate and Release Remote Loopback (Release Loopback)* [(a)]

Terminal	Switch	Result
Local End	Operate RLB NORMAL LLB switch to the NORMAL position while simultaneously pressing the ENABLE pushbutton.	RLB LED (Green)—Indicates loopback released and normal service restored. MINOR LED—Extinguished Minor alarm relay contacts open. DS3/RLB (Green)
Remote End	(If RMT ALM DISPLAY pushbutton was operated)	RLB LED (Green) DS3/LLB LED (Green) Remote alarm relay contacts open. (If RMT ALM DISPLAY pushbutton was not operated.) RMT/HSK LED—Extinguished LLB LED (Green) DS3/LLB LED (Green) Remote alarm relay contacts open.

(a) APS feature is disabled while system is in loopback mode. Any operated loopback circuit is automatically cleared before a new loopback is set up.

MAINTENANCE

The Trouble Analysis Table assumes that the system is properly equipped and has met the requirements to make an operating system. Multiple trouble indications may result from a single cause. However, it should be assumed that only one trouble exists. Major, Remote and Minor alarms should be cleared in that order.

Table 36. *Trouble Analysis Table—Product System*

Trouble Indication	Possible Cause	Corrective Action
1. DS3 LOS LED (Red) (Major or Minor alarm)	Incoming DS3 line or port failure	If on both Working and Protect System, clear line trouble. If only on Working or Protect System, replace FLC module. If on Unprotect System, trouble with DS3 line.
2. OPT LOS/OOF LED (Yellow)	Loss of Optical incoming signal	Check optical incoming signal level; if present, replace FLC module. If signal level absent, test Far End module fiber output level. If absent, replace Far End FLC module. If level is correct, replace fiber line.
3. BER/MOD FAIL LED (Red)	DS3 Output Failure	Press RESET pushbutton. If not corrected, replace FLC module.
	Controller or internal fuse failed	Press RESET pushbutton. If not corrected, replace FLC module.
	Laser Degradation	Replace FLC module (may not cause system failure).
4. OPT LOS/OOF LED (Red)	Optical incoming signal out-of-frame	Check optical incoming signal level. If present, replace FLC module. If signal level low, or absent, test Far End module fiber output level. If low or absent, replace Far End FLC module. If level is correct, replace fiber line or clean fiber connectors.
5. BER/MOD FAIL (Yellow)	Optical link exceeds Minor alarm BER	In Protect System mode there should be no APS. Trouble in near- or Far End FLC or in fiber line.
	Optical link exceeds Alarm APS BER	In Protect System mode there is an APS. In Unprotect System mode a Major threshold is declared. Replace Near End FLC. If trouble not cleared, replace Far End FLC. If problem still exists, replace fiber line.
6. RMT/HSKP LED (Yellow)	Far End trouble	Press RMT ALM DISPLAY pushbutton. If RMT/HSKP LED remains Yellow, it indicates Far End Housekeeping alarm. If RMT/HSKP LED is extinguished, LEDs are illuminated on front panel to indicate Far End trouble condition. If a DS3 LOS LED is red, operate the DS3 lines Far End loopback. If successful, it indicates Far End DS3 line failure. If an LED listed in Items 2, 3, 4, or 5 is illuminated, refer to those items for corrective action.

E1 QUAD FLC MODULE

This section covers installation, configuration switch settings, operation, and force switch information. For more detailed information, refer to the *E1 Quad Fiber Loop Converter User Manual*, LTPS-UM-8032-xx (see "Appendix F - Product Support" on page 89).

OPTIONS

Electrostatic Discharge (ESD) protection must always be used while handling circuit packs. An ESD grounding jack is provided on the mounting chassis for connection of ESD protective wrist bands. Whenever circuit cards are being installed or removed, always place the cards on a grounded approved antistatic mat. Stored cards should be wrapped in antistatic material.

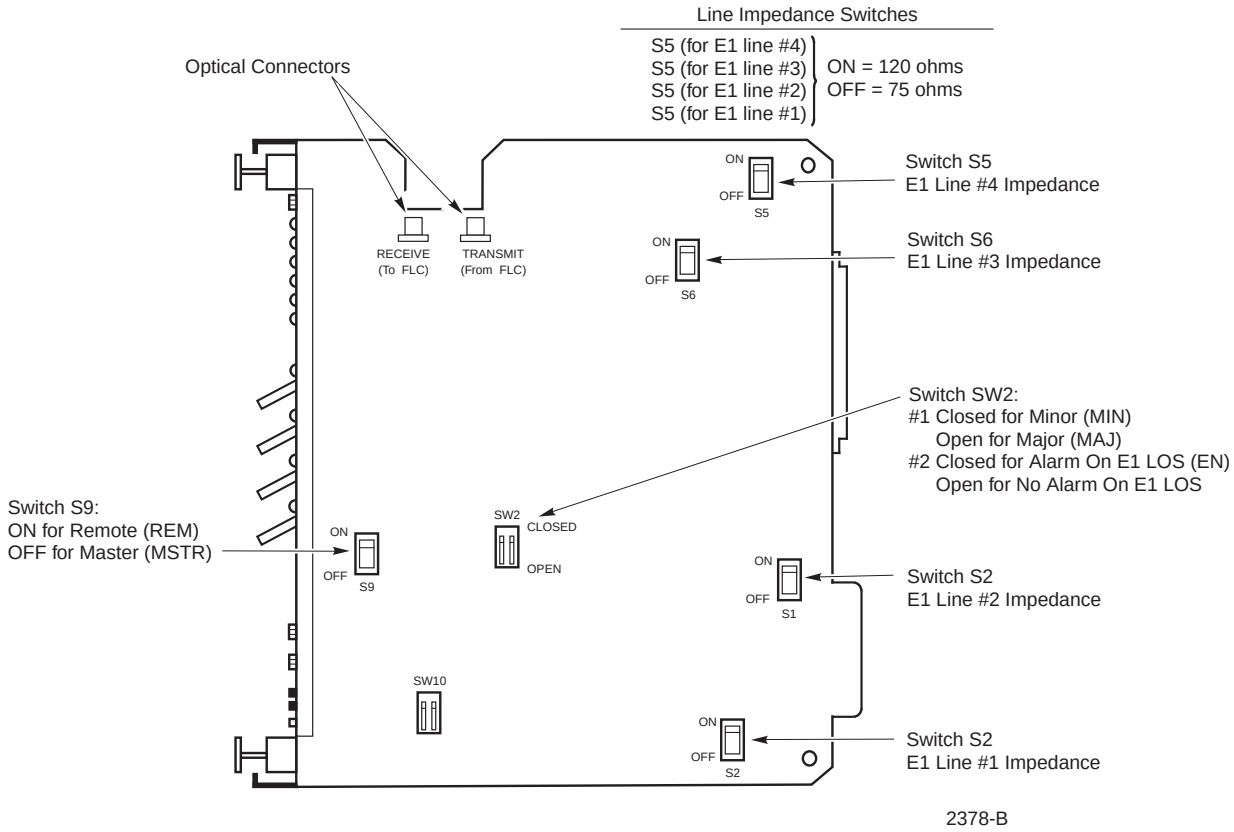

Line Impedance Switches
S5 (for E1 line #4)
S5 (for E1 line #3)
S5 (for E1 line #2)
S5 (for E1 line #1)
ON = 120 ohms
OFF = 75 ohms
Optical Connectors
RECEIVE (To FLC)
TRANSMIT (From FLC)
Switch S5 E1 Line #4 Impedance
Switch S6 E1 Line #3 Impedance
Switch SW2: #1 Closed for Minor (MIN) Open for Major (MAJ) #2 Closed for Alarm On E1 LOS (EN) Open for No Alarm On E1 LOS
Switch S9: ON for Remote (REM) OFF for Master (MSTR)
SW2 CLOSED OPEN
Switch S2 E1 Line #2 Impedance
SW10
Switch S2 E1 Line #1 Impedance
2378-B

Figure 27. *E1 QFLC Option Switches*

Table 37. *E1 QFLC Circuit Board and Front-Panel Switches*

Option and Switch Position	Location and Switch Parameters	Function
MSTR/REM S9 - Select Position 1	(left-hand side)	
• Configures the QFLC as either a master or remote module. • Must be opposite for each end. RMT/HSKP LED blinks if both ends are configured the same.	ON OFF	QFLC configured as a remote module. QFLC configured as a master module. Factory default setting is OFF.
EN [(a)] SW2 - Select Position 2	(right-hand side)	
• Selects an alarm or no alarm whenever an incoming E1 signal fails on an in-service line. If ON is selected, a MIN/MAJ option must also be selected at the Far End.	ON OFF	Furnish Alarm. No alarm furnished, includes not sending a Remote/Housekeeping alarm signal to the Far End (Factory default setting is ON). To alarm on an E1 receive port failure, the minor or major alarm must be enabled. It is recommended that Minor alarm remain enabled as shipped from the factory.
MIN/MAJ SW2 - Select Position 1	(left-hand side)	
When ALME1 option is set to ON, selects either a MINOR LED (yellow) and Minor alarm or a MAJOR LED (red) and major alarm whenever one or more incoming E1 signal fails.	Closed Open	Minor alarm Major alarm Factory default setting is ON.
	Front-Panel Switches	
RLB/NORMAL/UNEQPT	NORMAL UNEQPT	E1 line is in service. E1 line is not in service.
BER > I0^{-n} PROT SW	10^{-4} to 10^{-10}	Selects BER threshold for APS if BER on optical link exceeds level set. The three unmarked portions select APS at I0^{-4} BER, i .e., this feature is always enabled.
BER > I0^{-n} MIN ALM	10^{-6} to 10^{-10}	Selects BER threshold for Minor alarm if BER on optical link exceeds level set. The five unmarked positions are off, i.e., feature is always disabled.

(a) Also referred to as ALME1.

RLB/NORMAL/UNEQPT and BER PROT SW switch positions are compared and must be set in the same position at both ends of the optical link. The BER MIN ALARM and BER PROT SW position may be set to different thresholds.

QFLC software reads the switch positions during initialization and power-up, but when any switch changes are made on Working modules, the RESET pushbutton, located at both ends, must always be pressed after a selection is completed.

In unprotected configured systems, if the error rate exceeds the threshold set by the BER PROT SW select, a major alarm is declared.

INSTALLATION

Do not insert the module card-edge connectors into the chassis connectors. Exposure to invisible laser radiation may occur if the plug-in module card-edge connectors are allowed to connect with the chassis connectors prior to connecting the optical fiber to the plug-in module. Verify that all LEDs are dark (off) and the module is not engaged with the chassis connectors before proceeding.

Protective covers must be in place on the fiber connectors and on the QFLC fiber connectors to prevent dust and damage (see "Appendix D - Optical Fiber Systems Cleaning and Mating Instructions" on page 85). The fibers should be tagged for circuit identification and transmission direction. Be sure the module is properly optioned before placing it in the chassis.

The fibers should be installed and arranged in the chassis as outlined in the *FLC Eight-Position Universal Mounting Shelf User Manual*, ADCP-61-118, and the *FLC Four-Position Universal Wall Mount Cabinet User Manual*, ADCP-61-120 (see "Related Publications" on page iii).

When a module is not correctly optioned to match the Far End module (and/or adjacent module in a Protect System), certain LEDs flash at an approximate 2 Hz rate. Transport of the E1s may be disabled if certain system configuration settings do not match the other module(s) in the system. Refer to *E1 Quad Fiber Loop Converter User Manual* for information on configuration indicators.

Place the QFLC module in the chassis and connect the fiber as follows:

1 Align the module with the channel guides and slide it into the chassis until the two fiber connectors on the module are about 8 cm (three inches) out from the front of the chassis.

Do not look into the ends of any optical fiber. Do not look directly into the plug-in module fiber connectors. Exposure to invisible laser radiation may result. An optical power meter should be used to verify active fibers.

2 Remove the protective covers from the module transmit and receive fiber connectors.

3 Remove the protective covers from the fibers.

4 Mate the transmit and receive fiber connectors with the module transmit and receive fiber connectors.

5 With the module still withdrawn, adjust the fibers, as required, to remove any excess slack.

Always allow sufficient fiber length to permit routing without severe bends. Fibers may be permanently damaged if bent or curved to a radius of less than 3.8 cm (1.5 inches).

6 Carefully slide the module slowly into the chassis while guiding the fiber to form a service loop on the area above the mounting positions. The service loop is necessary to avoid stress on the fiber when the module is withdrawn from the chassis. Make certain the fibers do not kink or bend.

7 Insert the module until the card-edge connectors are fully mated. If there is excessive resistance, withdraw the module and check for alignment or obstructions.

8 Secure the module to the chassis with the two front-panel captive screws.

9 Repeat the steps for each additional module.

Configuration Switch Settings

Before setting any configuration switches, determine the correct system mode for all connected modules (for example, protected or unprotected system), then equip the appropriate E1 lines.

1 To put an E1 line into service, set the RLB/NORMAL/UNEQPT 3-position toggle switch to the NORMAL position for each line put into service. (To take an E1 line out of service, set the switch to the UNEQPT position.)

2 Set both the BER PROT SW switch and the BER MIN ALM switch to the desired threshold settings.

3 After setting all the configuration switches on one module, apply the automatic configuration matching feature by pressing and holding the LMPTST/FORCE SW pushbutton, then momentarily press the RMT ALM DISPLAY pushbutton. The other QFLCs in the system match their configurations to that module.

Operation

This section provides information on the normal operating mode and Protect and Unprotect System alarms.

Table 38. *Normal E1 QFLC System Operating Mode*

LED Status	Switch Status	Function
ONLINE/STDBY (green) Working System		Indicates the E1 QFLC Working system is providing the E1 service.
ONLINE/STDBY (yellow) Protect System		Indicates the E1 QFLC Protect System is in a standby mode.
LOS/LPBK LED (green)	RLB NORMAL UNEQPT (NORMAL position)	Indicates the E1 line or lines (I through 4) are equipped and in service with normal signal input.
LOS/LPBK LED (off)	RLB NORMAL UNEQPT (UNEQPT position)	Indicates the E1 line or lines (1 through 4) are not equipped.

Protect System Alarms

The alarms listed represent those detected and displayed by the Working E1 QFLC module at one end of the E1 QFLC system, except those associated with Protect System switching, which appear at both ends of the system. For the alarms not associated with Protect System switching, in most cases the E1 QFLC module at the Far End of the system will:

- Light the RMT/HSKP LED (yellow).
- Provide a Remote alarm for alarm duration plus 20 seconds.

To determine the alarm condition, press the RMT ALM DISPLAY pushbutton to display the LED status of the Far End module on the Near End front panel. If the alarm condition is a Housekeeping alarm, the RMT/HSKP LED remains illuminated (yellow), otherwise it extinguishes.

Table 39. *Protect System Alarms*

Alarm Condition	LED Status	Alarm	Remarks
Loss of E1 line input signal. (Signal not present on either Working or Protect System)	E1 LOS (red)		No Alarms, includes not sending a Remote alarm signal. Option switch SW2 position 2 OFF.
	E1 LOS (red) MAJOR (red) MINOR (yellow)	Major or Minor	Alarms, includes sending a Remote alarm Signal. With option switch SW2 position 2 ON and position 1 OFF = MAJOR LED and major alarm. Position 1 ON = MINOR LED and Minor alarm. Service does not transfer to Protect System. AIS sent on E1 drop.
E1 line receiver failure (Signal not present on either Working or Protect System)	E1 LOS (red) MAJOR (red) MINOR (yellow)	Major Minor	If E1 failure is on Working System, service will transfer to Protect System. To send a Remote alarm and initiate a MAJOR or MINOR LED and alarm, option switch SW2 position 2 ON and position 1 ON = MINOR LED and Minor alarm. (To provide an alarm for E1 receiver failure, it is recommended position 1 be ON for a MINOR LED and Alarm.) Position 1 OFF = MAJOR LED and major alarm.
Loss of E1 output signal	MOD FAIL (red) MINOR (yellow)	Minor	If E1 output failure is on Working System, service will transfer to Protect System.
Loss of optical input signal	OPT LOS/OOF (yellow) MINOR (yellow)	Minor	Indicates loss of incoming optical signal. RMT/HSKP LED is off even if the Far End is in alarm.
Optical signal Out-of-Frame	OPT/LOS/OOF (red) MINOR (yellow)	Minor	Indicates module is receiving faulty optical signal and is not able to frame it.
Laser degrade	MOD FAIL (red) MINOR (yellow)	Minor	Indicates module laser degradation. Does not initiate transfer to the Protect System.
BER PROT SW threshold exceeded	BER/MOD FAIL (yellow) MINOR (yellow)	Minor	Optical link exceeded BER APS threshold level. Switch to protection occurs.
BER MIN ALM threshold exceeded	BER/MOD FAIL (yellow) MINOR (yellow)	Minor	Optical link exceeded BER Minor alarm threshold level. No switch to Protect System.
Controller failure	MOD FAIL (red) MINOR (yellow)	Minor	Indicates internal module failure. Does not initiate a Remote alarm signal, but the Far End module illuminates MOD FAIL to indicate loss of communications with Near End.
Remote alarm	RMT/HSKP	Remote	Indicates Remote alarm.
E1 line loopback operated	LOS/LBPBK (yellow) MINOR (yellow)	Minor	Indicates the E1 line(s) that are in a loopback mode and are looped at the Far End.
Automatic switch to Protect System	ONLINE/STDBY (yellow) MINOR (yellow) ONLINE/STDBY (green)	Minor	(Working System – both ends) Indicates E1 service switched to Protect System. (Protect System – both ends) Indicates Protect System is providing the E1 service. Whatever caused the automatic switch to the Protect System to occur, activates the appropriate alarms as described in this table.
APS lockout	APS LKOUT (red) MINOR (yellow)	Minor	After third APS switch within a 24 hour period.

Continued

Table 39. *Protect System Alarms (Continued)*

Alarm Condition	LED Status	Alarm	Remarks
Manual switch to Protect System	ONLINE/STDBY (yellow)		(Working System – both ends) Indicates Working System is in standby mode.
	FORCE SW (yellow) ONLINE/STDBY (green) MINOR (yellow)	Minor	(Protect System – both ends) Indicates Protect System was force-switched to provide E1 service.
Fuse failure (Internal)	MOD FAIL (red) MINOR (yellow)	Minor	Indicates module failure. Lack of other indications signifies fuse failure. Far End LOS/OOF LED (yellow). No Remote alarm initiated.
Power supply failure		Minor Major [(a)]*	Indicates power supply failure. Far End LOS/OOF LED (yellow). No Remote alarm initiated.
Power supply degradation	MOD FAIL (red) Minor (yellow)	Minor	Indicates on-board power supplies are outside tolerance limits.

(a) Major alarm or power failure provided by MPU module.

Whenever an alarm is activated, the associated alarm relay contacts close and remain closed for the duration of the alarm condition plus 20 seconds. Exception is a controller, fuse, or power supply failure which does not extend the alarm duration.

Unprotect System Alarms

For most of the alarm condition listed in Table 40, the E1 QFLC module at the Far End of the system will:

- Light the RMT/HSKP LED (yellow).
- Provide a Remote alarm for the alarm duration plus 20 seconds.

To determine the alarm condition. Press the RMT ALM DISPLAY pushbutton to display the LED status of the Far End module on the Near End module front panel. If the alarm condition is a Housekeeping alarm, the RMT/HSKP LED will remain illuminated (yellow), otherwise it will extinguish.

Table 40. *Unprotect System Alarms*

Alarm Condition	LED Status	Alarm	Function
Loss of E1 input signal either due to E1 line or E1 receiver failure	E1 LOS		Identifies the equipped E1 line or lines (I through 4) that do not have input signal present.
	MAJOR (red) or MINOR (yellow)		Major, minor or no alarm relay closure depends on how the following option switches were set: ALME1 option switch: ON = Alarm OFF = No alarm (includes not sending a Remote alarm signal to the Far End.) MIN/MAJ option switch: ON = MINOR LED (yellow) and alarm signal OFF = MAJOR LED (red) and alarm signal An AIS is transmitted on the corresponding E1 output line by the Far End module.

Continued

Table 40. *Unprotect System Alarms (Continued)*

Alarm Condition	LED Status	Alarm	Function
Loss of E1 output signal	MOD FAIL (red) MAJOR (red)	Major	Indicates loss of one or more E1 output signals.
Loss of optical input signal	OPT LOS/OOF (yellow) MAJOR (red)	Major	Indicates loss of incoming optical signal. AIS transmitted on E1 outputs. RMT/HSKP LED is off even if the Far End module is in alarm.
Optical signal out-of-frame	OPT LOS/OOF (red) MAJOR (red)	Major	indicates module is receiving a faulty optical signal and is not able to frame on the incoming optical signal. AIS inserted on E1 outputs.
BER PROT SW threshold exceeded	BER/MOD FAIL (yellow) MAJOR (red)	Major	Optical link exceeded BER threshold level.
BER MIN ALM threshold exceeded	BER/MOD FAIL MINOR (yellow)	Minor	Optical link exceeded BER Minor alarm threshold level.
Laser degrade	MOD FAIL (red) MINOR (yellow)	Minor	Indicates module laser degradation.
Controller failure	MOD FAIL (red) MAJOR (red)	Major	Indicates internal module failure. Does not initiate Remote alarm signal, but Far End module will illuminate MOD FAIL (red) to indicate loss of communication with controller in the Near End module.
Remote alarm	RMT/HSKP	Remote	Indicates Remote alarm.
E1 line loopback	LOS/LPBK (yellow) MINOR (yellow)	Minor	Indicates the E1 line or lines that are in a loopback mode and are looped back at the Far End module.
Fuse failure (internal)	MOD FAIL (red)	Major	Indicates module failure and lack of other indications signifies fuse failure. Does not initiate Remote alarm signal. Far End LOS/OOF LED (yellow).
Power supply fails	MOD FAIL (red)	Major	Indicates power supply failure. Does not initiate Remote alarm signal. Far End LOS/OOF LED (yellow).
Power supply degradation	MOD FAIL (red) MAJOR (red)	Major	Indicates on-board voltages are outside tolerance limits

Whenever an alarm is activated, the associated alarm relay contacts close and remain closed for the duration of the alarm condition plus 20 seconds. Exception is a controller, fuse or power supply failure which does not extend the alarm duration.

Force Switch–––Working System to Protect System

Table 41. *Force Switch – Working to Protect System*

E1 QFLC System	Switch	Function
Protect System	Press LMPTST/FORCE SW pushbutton simultaneously with ENABLE pushbutton.	Lights ONLINE/STDBY LED (green) at both ends to show E1 service is on Protect System. Lights FORCE SW LED (yellow) at both ends to show service was force-switched to the Protect System and the automatic protect switch feature is disabled. Lights MINOR LED (yellow) at both ends. Lights RMT/HSKP LED (yellow) at both ends. Minor alarm and Remote alarm relays close at both ends.
Working System		Lights ONLINE/STDBY LED (yellow) at both ends to show the E1 service is not on Working System.

A force switch completes within 60 milliseconds after switches are pressed.

FLC-A10MPU MAIN PROCESSOR UNIT

OPTIONS

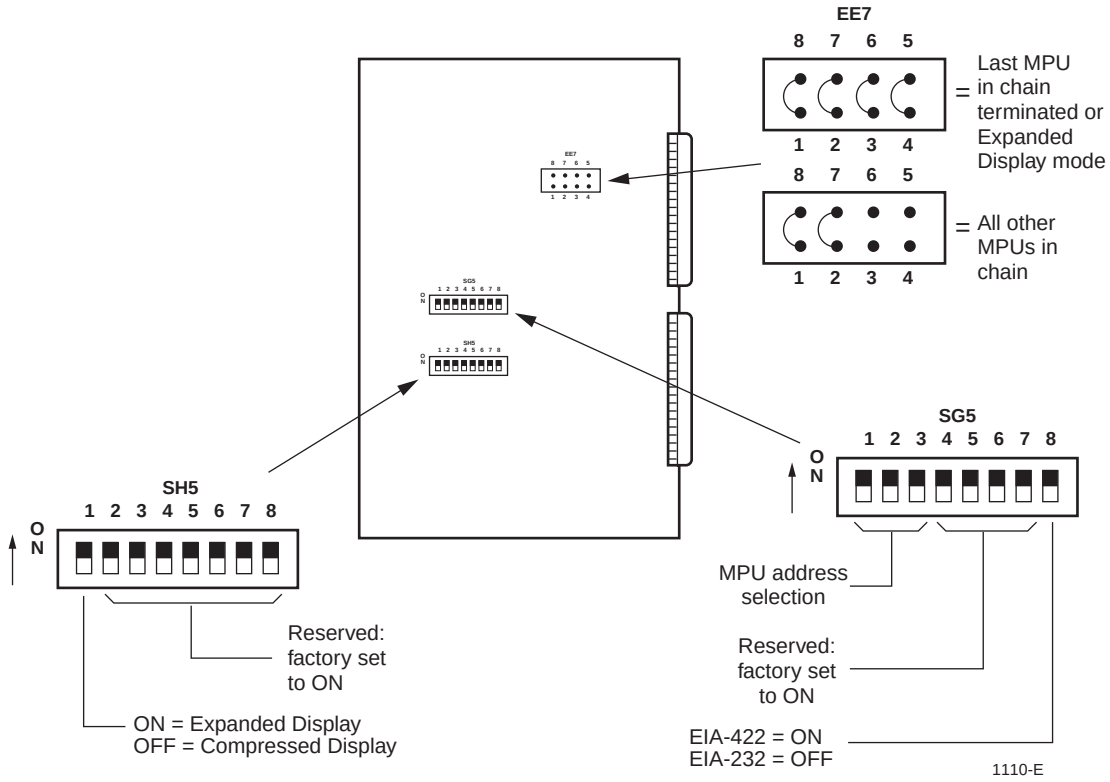

EE7
8 7 6 5
1 2 3 4
= Last MPU in chain terminated or Expanded Display mode
8 7 6 5
1 2 3 4
= All other MPUs in chain
SG5
1 2 3 4 5 6 7 8
O N
SH5
1 2 3 4 5 6 7 8
O N
MPU address selection
Reserved: factory set to ON
Reserved: factory set to ON
EIA-422 = ON
EIA-232 = OFF
ON = Expanded Display
OFF = Compressed Display
1110-E

Figure 28. *FLC-A10 MPU Option Switch and Jumpers*

Table 42. *SH5 Switches*

Switch	Position	Function
1	ON	MPU provides Expanded (a) displays.
1	OFF	MPU provides Compressed (b) displays.
2–8 (c)	ON	Reserved. Factory set to ON.

(a) In Expanded Display mode, set SG5-1, 2, and 3 to ON; SG 5-8 may be ON or OFF (EIA-422 or EIA-232).

(b) In Compressed Display mode, SG5-1, 2, and 3 are set to the MPU module number and SG5-8 must be ON (EIA-422).

(c) SG5-8 determines the APR (Alarm Processing Telemetry Remote) interface. When switch 8 is ON, EIA-422 mode is selected and APR cable must connect to Port 1. When switch 8 is OFF, EIA-232 protocol is selected and the APR cable must connect to Port 2.

Table 43. *SG5 Switches*

Switch	Position	Function
1–3	–	Selects MPU number. See Table 42 on page 67.
4–7	ON	Reserved. Factory set to ON.
8	ON	Selects EIA-422 (Port 1) TBOS interface.
8	OFF	Selects EIA-232 (Port 2) TBOS interface.

Table 44. *SG5 Switch Positions*

Module Number	Position 1	Position 2	Position 3
MPU-1	ON	ON	ON
MPU-2	OFF	ON	ON
MPU-3	ON	OFF	ON
MPU-4	OFF	OFF	ON
MPU-5	ON	ON	OFF
MPU-6	OFF	ON	OFF
MPU-7	ON	OFF	OFF
MPU-8	OFF	OFF	OFF

EE7 Jumpers

The EE7 jumpers between pins 4 and 5, and pins 3 and 6, are used to terminate the EIA-422 communications line. Jumpers between pins 1 and 8, and pins 2 and 7, are not changed during installation and should remain in place.

- **In the Expanded Display Mode configuration** (single MPU on the TBOS interface), ensure jumpers are installed between EE7 wire-wrap pins 4 and 5, and between pins 3 and 6.
- **In the Compressed Display Mode configuration** (multiple MPUs on a single APR interface), EE7 jumpers depend on the order in which the MPUs are daisy-chained together. Only the MPU module at the end of the daisy chain string is jumpered by placing jumpers only across EE7 pins 4 and 5, and pins 3 and 6. Remove EE7 jumpers between pins 4 and 5, and pins 3 and 6 on all MPUs on the daisy chain except to the end module.

FRONT PANEL

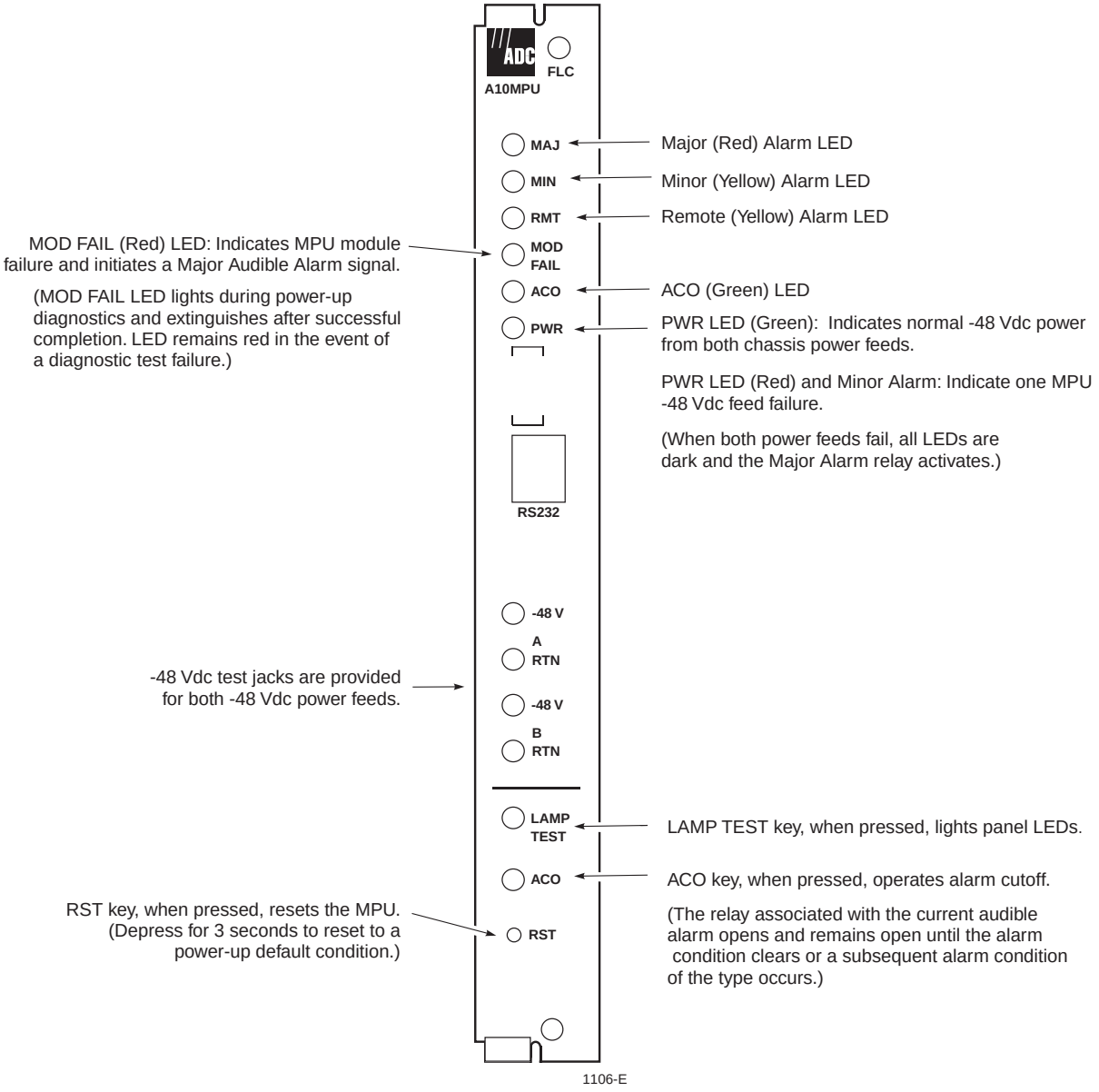

ADC
FLC
A10MPU
MAJ
MIN
RMT
MOD FAIL
ACO
PWR
RS232
-48 V A RTN
-48 V B RTN
LAMP TEST
ACO
RST
1106-E
Major (Red) Alarm LED
Minor (Yellow) Alarm LED
Remote (Yellow) Alarm LED
MOD FAIL (Red) LED: Indicates MPU module failure and initiates a Major Audible Alarm signal.
(MOD FAIL LED lights during power-up diagnostics and extinguishes after successful completion. LED remains red in the event of a diagnostic test failure.)
ACO (Green) LED
PWR LED (Green): Indicates normal -48 Vdc power from both chassis power feeds.
PWR LED (Red) and Minor Alarm: Indicate one MPU -48 Vdc feed failure.
(When both power feeds fail, all LEDs are dark and the Major Alarm relay activates.)
-48 Vdc test jacks are provided for both -48 Vdc power feeds.
LAMP TEST key, when pressed, lights panel LEDs.
ACO key, when pressed, operates alarm cutoff.
(The relay associated with the current audible alarm opens and remains open until the alarm condition clears or a subsequent alarm condition of the type occurs.)
RST key, when pressed, resets the MPU. (Depress for 3 seconds to reset to a power-up default condition.)

Figure 29. *FLC-A10MPU Front Panel*

INSTALLATION

1. Configure SH5 and SG5 switches, and EE7 jumpers for the system configuration. See Figure 28 on page 67 and Table 42 on page 67 for additional information.
2. Slide the MPU module into the left mounting position (marked O, ALM, or MPU).
3. Secure the module to the chassis with the captive screws.

If the cabinet contains a DS3 FLC module, the DS3 Adapter Kit interface panel is used in place of the MPU interface panel (see Figure 30).

4 Install the interface panel.

- **Front access shelves**. From the front of the cabinet, slide the MPU interface panel and cable into the mounting position, facing forward, while routing the MPU/TBOS cable through the opening at the back of the slot. Plug the cable into backplane connector J26.
- **Rear access shelves**. From the rear of the cabinet, slide the MPU interface panel and cable into the mounting position, facing toward the rear, while passing the cable through the opening above the slot, across the card cage, and down the back plane. Plug the cable into J26.

5 Secure the interface panel to the four mounting tabs with the screws provided.

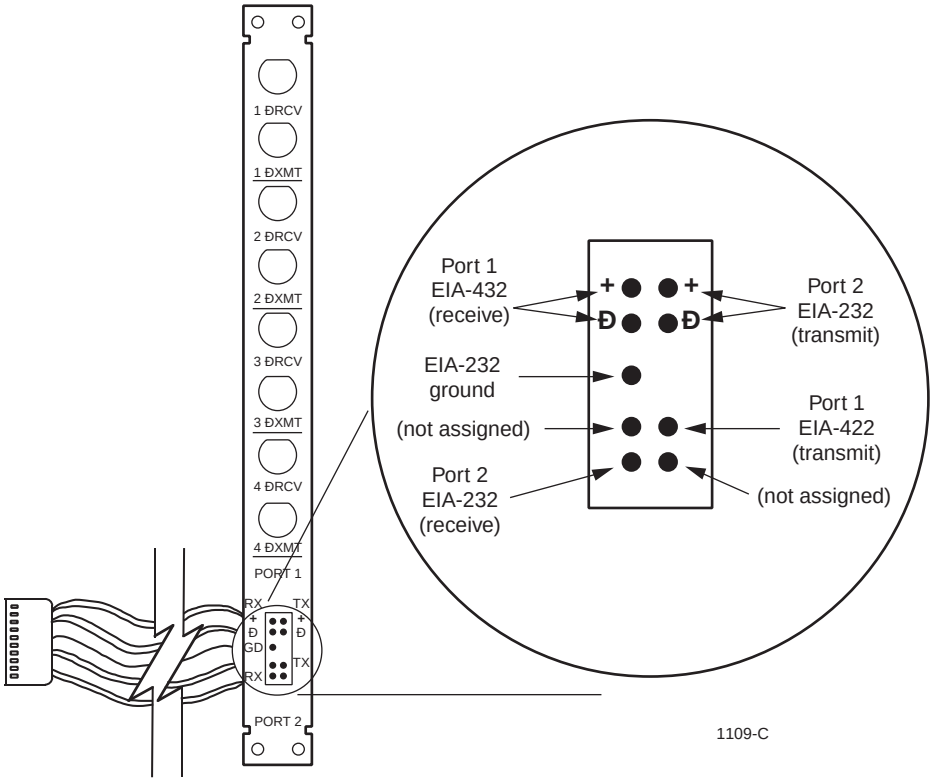


Figure 30. *DS3 Adapter Kit interface panel*

TBOS Connections

- The TBOS communication link is serial, asynchronous, half-duplex, 2400 baud.
- TBOS connection between the APR and MPU interface panel should be made with 22 to 26 AWG 100Ω twisted pair wire.
- In electrically noisy environments, shield-grounded cable may be used.
- Switch SG5-8 determines the line interface. SG5-8 ON selects EIA-422 interface and uses interface panel port 1. SG5-8 OFF selects EIA-232 interface and uses interface panel port 2.
- Maximum cable length is 4,000 ft. for Port 1 (EIA-422) interface and 50 ft. for Port 2 (EIA-232) interface.

Installation Verification

MPU initialization software executes automatically during power up. Initialization software executes automatically when power is applied to the module or the reset pushbutton is pressed for three seconds. Initialization software executes a diagnostic self-check, initializes communication channels to FLCs, initializes software data structures, and starts application tasks. Initialization failure is indicated by the MOD FAIL LED remaining lit.

Installation verification should also include the following:

- Press the LAMP TEST pushbutton to ensure all LEDs are operating properly.
- Test the TBOS connection by verifying indications on the Scan Display(s) with the LED status shown on the FLC and MPU front panels.

TBOS Display

- The TBOS Display format is determined by switch SH5-1.
- If SH5-1 is ON, Expanded Display information is presented to the APR. In this mode, one Scan display and one Command display is presented for each module slot.
- If switch SH5-1 is OFF, Compressed Display information is presented to the APR. One Scan display and one Command display is presented for each shelf. The display number is determined by the MPU address switches (SG5-1,2,3)

Abbreviations used in the Scan and Command display maps are listed in Table 45.

Table 45. *Scan and Command Display Abbreviations*

Scan and Command Name	Abbreviations
MODULES	
Main Processor Unit (MPU)	MP
Local FLC	L1 to L8
Remote FLC	R1 to R8
CIRCUITS	
Optical	OP
DS3	D3
DS1/E1 (lines 1 through 4)	D1A to D1D
ALARMS	
Major	MJ
Minor	MN
Remote	RM
Housekeeping (Expanded Mode)	HK
Housekeeping (Compressed Mode)	HK1 to HK4
Module Failure	MF
Loss Of Signal (qualified by the Circuits Abbreviation listed above)	LOS
Electrical LOS of Signal	ELOS

Continued

Table 45. *Scan and Command Display Abbreviations (Continued)*

Scan and Command Name	Abbreviations
Optical Out Of Frame	OOF
Alarm Indication Signal (Optical)	AIS
Optical Alarm (Results from LOS, OOF, or AIS)	OA
Bit Error Rate Threshold Crossing (Optical)	BER
Laser Degradation	LA
MPU Power Fail	PF
STATUS	
FLC Off-Line	OFL
APS Lockout	AL
ACO (Alarm Cut-off)	AC
FLC Absent Module	AM
Equipped Circuit (DS1/E1 lines D1A to D1D)	EQ
DS1/E1 Line Code (B8ZS/AMI) (D1A to D1D)	B8
Local Loopback (DS3)	LLB
Remote Loopback (DS3 and DS1/E1 lines D1A to D1D)	RLB
Protected Module	PR
Force Switch	FS
COMMANDS	
Module Reset	MR
Force Switch	FS
Enable ACO	AC
Equip Circuit	EQ
Set DS1/E1 Line Code (B8ZS)	B8
Set DS1/E1 Line Code (AMI)	AMI
Local Loopback	LLB
Remote Loopback	RLB

Expanded Scan Display

Figure 31 documents Expanded Scan Display 1, which includes status and alarm data for the module in slot 1, and for the MPU.

MP/MJ 1	MP/MN 2	MP/RM 3	MP/PF 4	L1/MF 5	R1/MF 6	L1/HK 7	R1/HK 8
L1/LOS/ OP 9	R1/LOS/ OP 10	L1/OOF/ OP 11	R1/OOF/ OP 12	L1/AIS/ OP 13	R1/AIS/ OP 14	L1/LA/ OP 15	R1/LA/ OP 16
L1/BER/ OP 17	R1/BER OP 18	L1/LOS/ D3 19	R1/LOS/ D3 20	L1/MJ 21	R1/MJ 22	L1/MN 23	R1/MN 24
L1/LOS/ D1A 25	R1/LOS/ D1A 26	L1/LOS/ D1B 27	R1/LOS/ D1B 28	L1/LOS/ D1C 29	R1/LOS/ D1C 30	L1/LOS/ D1D 31	R1/LOS/ D1D 32
L1/B8/ D1A 33	R1/B8/ D1A 34	L1/B8/ D1B 35	R1/B8/ D1B 36	L1/B8/ D1C 37	R1/B8/ D1C 38	L1/B8/ D1D 39	R1/B8/ D1D 40
L1/LLB/ D3 41	R1/LLB/ D3 42	L1/RLB/ D3 43	R1/RLB/ D3 44	L1/EQ/ D1A 45	L1/EQ/ D1B 46	L1/EQ/ D1C 47	L1/EQ/ D1D 48
L1/RLB/ D1A 49	R1/RLB/ D1A 50	L1/RLB/ D1B 51	R1/RLB/ D1B 52	L1/RLB/ D1C 53	R1/RLB/ D1C 54	L1/RLB/ D1D 55	R1/RLB/ D1D 56
MP/AC 57	L1/AM 58	L1/AL 59	L1/OFL 60	L1/PR 61	L1/FS 62	 63	RESERVED 64

Figure 31. *Expanded Scan Display 1*

Expanded Scan Display 2 through 8 (Figure 32) includes status and alarm data for the modules in slot 2 through slot 8, respectively. Quotation marks ("_") indicate display of positions 2, 3, 4, 5, 6, 7, or 8.

				L_/MF	R_/MF	L_/HK	R_/HK
1	2	3	4	5	6	7	8
L_/LOS/ OP	R_/LOS/ OP	L_/OOF/ OP	R_/OOF/ OP	L_/AIS/ OP	R_/AIS/ OP	L_/LA/ OP	R_/LA/ OP
9	10	11	12	13	14	15	16
L_/BER/ OP	R_/BER OP	L_/LOS/ D3	R_/LOS/ D3	L_/MJ	R_/MJ	L_/MN	R_/MN
17	18	19	20	21	22	23	24
L_/LOS/ D1A	R_/LOS/ D1A	L_/LOS/ D1B	R_/LOS/ D1B	L_/LOS/ D1C	R_/LOS/ D1C	L_/LOS/ D1D	R_/LOS/ D1D
25	26	27	28	29	30	31	32
L_/B8/ D1A	R_/B8/ D1A	L_/B8/ D1B	R_/B8/ D1B	L_/B8/ D1C	R_/B8/ D1C	L_/B8/ D1D	R_/B8/ D1D
33	34	35	36	37	38	39	40
L_/LLB/ D3	R_/LLB/ D3	L_/RLB/ D3	R_/RLB/ D3	L_/EQ/ D1A	L_/EQ/ D1B	L_/EQ/ D1C	L_/EQ/ D1D
41	42	43	44	45	46	47	48
L_/RLB/ D1A	R_/RLB/ D1A	L_/RLB/ D1B	R_/RLB/ D1B	L_/RLB/ D1C	R_/RLB/ D1C	L_/RLB/ D1D	R_/RLB/ D1D
49	50	51	52	53	54	55	56
	L_/AM	L_/AL	L_/OFL	L_/PR	L_/FS		RESERVED
57	58	59	60	61	62	63	64

Figure 32. *Expanded Scan Display 2 through 8*

Expanded Command Display

Expanded Command Displays provide command points from which TBOS controls the MPU, B3, and D3 QFLC or DS3 FLC modules. Table 46 lists the module types and supported commands.

Table 46. *Modules and Supported Commands*

Module	Supported Commands	Command Mnemonics
MPU	Module Reset	MR
MPU	Enable ACO	AC
B3/D3 QFLC	Module Reset	MR
B3/D3 QFLC	Force Switch	FS ON/OFF
B3/D3 QFLC	Set Remote Loopback State	RLB ON/OFF
B3/D3 QFLC	Set AMI Linecode	AMI
B3/D3 QFLC	Set B8ZS Linecode	B8
B3/D3 QFLC	Equip/Unequip DS1/E1 Line	EQ ON/OFF
DS3 FLC	Module Reset	MR
DS3 FLC	Force Switch	FS ON/OFF
DS3 FLC	Set Local Loopback State	LLB ON/OFF
DS3 FLC	Set Remote Loopback State	RLB ON/OFF
E1 QUAD [(a)]	Module Reset Force Switch Set Remote Loopback State Equip/Unequip DS1/E1 Line	MR FS ON/OFF RLB ON/OFF EQ ON/OFF

(a) AMI/B8ZS commands are not applicable to E1 Quad.

Expanded Command Display 1 (Figure 33) presents the command points that may be issued by TBOS to control the module in slot 1 and the MPU.

L1/EQ D1A On 1	L1/EQ/ D1A OFF 2	 3	 4	L1/EQ/ D1B ON 5	L1/EQ/ D1B OFF 6	 7	 8
L1/EQ D1C ON 9	L1/EQ/ D1C OFF 10	 11	 12	L1/EQ/ D1D ON 13	L1/EQ/ D1D OFF 14	 15	 16
L1/RLB/ D1A ON 17	L1/RLB/ D1A OFF 18	R1/RLB/ D1A ON 19	R1/RLB/ D1A OFF 20	L1/RLB/ D1B ON 21	L1/RLB/ D1B OFF 22	R1/RLB/ D1B ON 23	R1/RLB/ D1B OFF 24
L1/RLB/ D1C ON 25	L1/RLB/ D1C OFF 26	R1/RLB/ D1C ON 27	R1/RLB/ D1C OFF 28	L1/RLB/ D1D ON 29	L1/RLB/ D1D OFF 30	R1/RLB/ D1D ON 31	R1/RLB/ D1D OFF 32
L1/B8/ D1A 33	L1/AMI/ D1A 34	 35	 36	L1/B8/ D1B 37	L1/AMI/ D1B 38	 39	 40
L1/BB/ D1C 41	L1/AMI D1C 42	 43	 44	L1/E8/ D1D 45	L1/AMI/ D1D 46	 47	 48
L1/LLB/ D3 ON 49	L1/LLB/ D3 OFF 50	R1/LLB/ D3 ON 51	R1/LLB/ D3 OFF 52	L1/RLB/ D3 ON 53	L1/RLB/ D3 OFF 54	R1/RLB/ D3 ON 55	R1/RLB/ D3 OFF 56
MP/AC 57	Mp/MR 58	L1/MR 59	R1/MR 60	L1/FS ON 61	L1/FS OFF 62	 63	RESERVED 64

Figure 33. *Expanded Command Display 1*

Expanded Command Displays 2 through 8 (Figure 34) present the command points used by TBOS to control the modules in slots 2 through, respectively. Quotations marks ("_") denote displays of positions 2, 3, 4, 5, 6, 7, or 8.

L_/EQ D1A On 1	L_/EQ/ D1A OFF 2	 3	 4	L_/EQ/ D1B ON 5	L_/EQ/ D1B OFF 6	 7	 8
L_/EQ D1C ON 9	L_/EQ/ D1C OFF 10	 11	 12	L_/EQ/ D1D ON 13	L_/EQ/ D1D OFF 14	 15	 16
L_/RLB/ D1A ON 17	L_/RLB/ D1A OFF 18	R_/RLB/ D1A ON 19	R_/RLB/ D1A OFF 20	L_/RLB/ D1B ON 21	L_/RLB/ D1B OFF 22	R_/RLB/ D1B ON 23	R_/RLB/ D1B OFF 24
L_/RLB/ D1C ON 25	L_/RLB/ D1C OFF 26	R_/RLB/ D1C ON 27	R_/RLB/ D1C OFF 28	L_/RLB/ D1D ON 29	L_/RLB/ D1D OFF 30	R_/RLB/ D1D ON 31	R_/RLB/ D1D OFF 32
L_/B8/ D1A 33	L_/AMI/ D1A 34	 35	 36	L_/B8/ D1B 37	L_/AMI/ D1B 38	 39	 40
L_/BB/ D1C 41	L_/AMI D1C 42	 43	 44	L_/E8/ D1D 45	L_/AMI/ D1D 46	 47	 48
L_/LLB/ D3 ON 49	L_/LLB/ D3 OFF 50	R_/LLB/ D3 ON 51	R_/LLB/ D3 OFF 52	L_/RLB/ D3 ON 53	L_/RLB/ D3 OFF 54	R_/RLB/ D3 ON 55	R_/RLB/ D3 OFF 56
  57	 58	L_/MR 59	R_/MR 60	L_/FS ON 61	L_/FS OFF 62	 63	RESERVED 64

Figure 34. *Expanded Command Displays 2 through 8*

Compressed Scan Display

Each Compressed Scan Display presents alarm and status data for all modules in one shelf and the modules optically connected to them. The display number associated with the shelf is determined by MPU address switches SG5-1, 2, and 3 (see Figure 35).

HK1 is formed by "ORing" the Housekeeping status from slots 1 and 2. Similarly, HK2 is formed from slots 3 and 4, HK3 from slots 5 and 6, and HK4 from slots 7 and 8.

MP/MJ 1	MP/MN 2	MP/RM 3	MP/PF 4	HK1 5	HK2 6	HK3 7	HK4 8
L1/MJ 9	L2/MJ 10	L3/MJ 11	L4/MJ 12	L5/MJ 13	L6/MJ 14	L7/MJ 15	L8/MJ 16
R1/MJ 17	R2/MJ 18	R3/MJ 19	R4/MJ 20	R5/MJ 21	R6/MJ 22	R7/MJ 23	R8/MJ 24
L1/MN 25	L2/MN 26	L3/MN 27	L4/MN 28	L5/MN 29	L6/MN 30	L7/MN 31	L8/MN 32
R1/MN 33	R2/MN 34	R3/MN 35	R4/MN 36	R5/MN 37	R6/MN 38	R7/MN 39	R8/MN 40
L1/R1/ELOS 41	L2/R2/ELOS 42	L3/R3/ELOS 43	L4/R4/ELOS 44	L5/R5/ELOS 45	L6/R6/ELOS 46	L7/R7/ELOS 47	L8/R8/ELOS 48
L1/R1/OA 49	L2/R2/OA 50	L3/R3/OA 51	L4/R4/OA 52	L5/R5/OA 53	L6/R6/OA 54	L7/R7/OA 55	L8/R8/OA 56
MP/AC 57	 58	 59	 60	 61	 62	 63	RESERVED 64

Figure 35. *Compressed Scan Displays 1 through 8*

Compressed Command Display

Compressed Command Display (Figure 36) presents the commands points used by TBOS to reset modules in one shelf and FLCs optically connected to them. TBOS may also issue an Alarm Cutoff function (MP/AC) to the MPU. The display number associated with the shelf is determined by the MPU address switches SG5-1, 2, and 3).

MP/AC 1	MP/MR 2	3	4	5	6	7	8
L1/MR 9	L2/MR 10	L3/MR 11	L4/MR 12	L5/MR 13	L6/MR 14	L7/MR 15	L8/MR 16
R1/MR 17	R2/MR 18	R3/MR 19	R4/MR 20	R5/MR 21	R6/MR 22	R7/MR 23	R8/MR 24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	RESERVED 64

Figure 36. *Compressed Command Displays 1 through 8*

OPERATION

MPU operation consists of alarm reporting. Alarms are sensed from all in-shelf FLCs and the FLCs optically connected to them.

A summary of the alarm condition is indicated on the MPU front panel (see Table 47).

Table 47. *FLC-MPU Alarms*

ALARM CONDITION	Alarm Type			
	Local On-Line Systems		Off-Line System	
	Protect	Unprotect	Protect	Remote
Housekeeping	Minor	Minor	Minor	Remote
Module Fail	Minor	Major	Minor	Remote
Laser Degradation	Minor	Major	Minor	Remote
AIS (Alarm Indication Signal) (DS3)	Minor	Major	Minor	Remote
OOF (Out-Of-Frame)	Minor	Major	Minor	Remote
LOS (Loss-Of-Signal)	Minor	Major	Minor	Remote
BER (Bit Error Rate) (DS3)	Minor	Minor	Minor	Remote
RLB (Remote Loopback)	N/A	N/A	N/A	Remote
LLB (Local Loopback) (DS3)	Minor	Minor	Minor	N/A
Switch (Protect System)	Minor	Minor	Minor	Remote
Optical Mismatch	Minor	Minor	Minor	Remote
Power Fail (1 Supply Feed) (MPU)	Minor	Minor	N/A	N/A
Power Fail (2 Supply Feeds) (MPU)	Major	Major	N/A	N/A

MAINTENANCE

The Trouble Analysis Table assumes that the MPU system is properly installed. Normally, alarm indications on the MPU front panel reflect alarms generated by modules on the shelf (Major or Minor) or those modules optically connected to them (Remote).

Table 48. *MPU Trouble Analysis Table*

Trouble	Possible Cause	Corrective Action
Major alarm LED (Red)	One or more FLC units in alarm	Locate local or remote FLC that is in alarm and correct failure.
Minor alarm LED (Yellow)	One or more FLC units in alarm	Locate local or remote FLC that is in alarm and correct failure.
MOD Fail LED (Red)	Unit did not successfully complete self test or subsequently detected an on-board failure.	**1** Press reset (RST) pushbutton. **2** If MOD Fail remains lit after ten seconds, replace module.

APPENDIX A - ALARM INFORMATION

MAJOR AND MINOR ALARMS

When a Major or Minor alarm condition occurs, the alarm relays Normally Open (NO) and Common (COM) dry contacts are closed to furnish a closed (loop) condition to the alarm surveillance equipment. When the alarm condition is cleared, the relay returns to its normally open position. One Major and Minor alarm connection is usually provided for a chassis.

REMOTE ALARM

The Remote relay at the Near End is activated, but does not distinguish either a Major, Minor, or Housekeeping (Site) alarm signal from the Far End. The Remote alarm Relay also provides NO and COM dry contacts. A Remote alarm connection is usually provided for each mounting position in the chassis.

The Major, Minor, and Remote alarm relays on the Quad FLC remain closed for the duration of the alarm condition, plus 20 seconds. Exception is a power or controller failure.

HOUSEKEEPING (SITE) ALARM

A Housekeeping alarm is provided for any site alarm the user may wish to connect. The Housekeeping alarm relay is activated by a closed circuit (loop) furnished by user or ADC associated equipment. Whenever a Housekeeping alarm is activated, a Remote alarm signal is sent to the Far End. A Housekeeping alarm connection is usually provided for each mounting position in the chassis.

APPENDIX B - STORING FIBER ON SPOOLS

- Fiber spools are provided for storing the excess length of optical fiber patch cords. The fibers should enter and exit the spools as shown in Figure 37.
- Wind the excess fiber in a clockwise direction around the spools until all the excess length is stored. Allow some slack in the fibers since they are coiled around the spools.

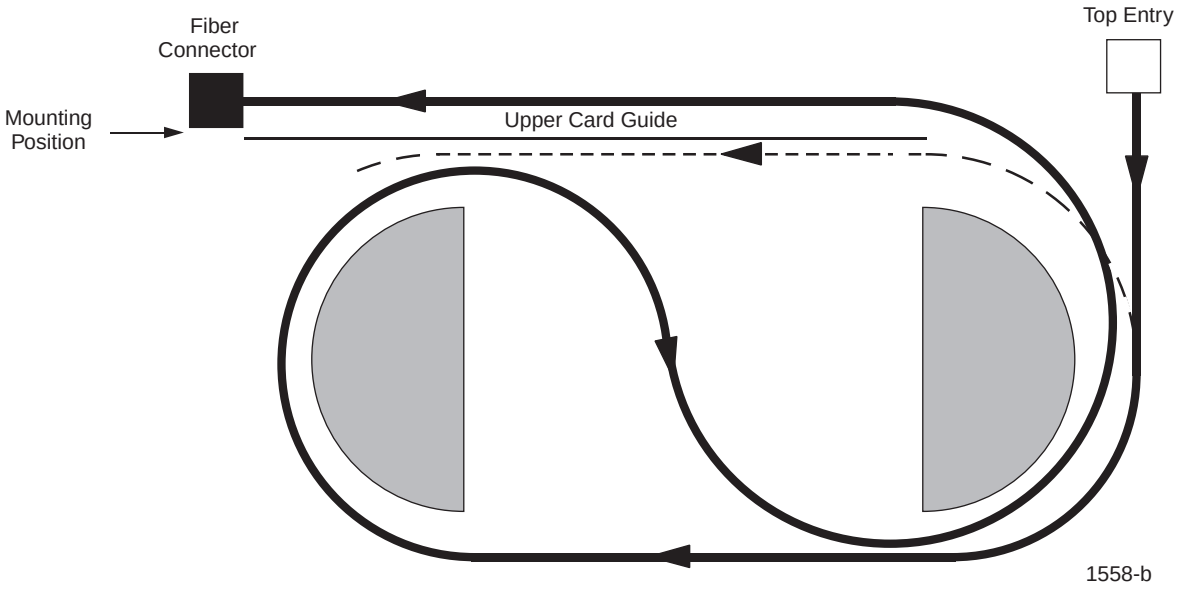


Figure 37. *Spools—Storing Fiber*

APPENDIX C - UNIVERSAL WALL MOUNT AND MOUNTING SHELF POSITION USAGE

Table 49 reflects the options available for slot positions 1, 2, 3, and 4.

Table 49. *FLC Four-Position Universal Wall Mount Cabinet* [(a)]

Option	Slot Position Number [(b)]				Number of LInes Transported
	1	2	3	4	
Option 1	QFLC or DS3 FLC Working	QFLC or DS3 FLC Protect	QFLC or DS3 FLC Working	QFLC or DS3 FLC Protect	Up to 8 DS1/E1s or 2 DS3s
Option 2	QFLC or DS3 FLC Working	QFLC or DS3 FLC Protect	Not Used	Not Used	2 DS1/E1s and 1 DS3
Option 3	Not Used	Not Used	QFLC or DS3 FLC Working	QFLC or DS3 FLC Protect	2 DS1/E1s and 1 DS3
Option 4	QFLC or DS3 FLC Unprotect	Not Used	QFLC or DS3 FLC Unprotect	Not Used	Up to 8 DS1/E1s or 2 DS3s
Option 5	QFLC or DS3 FLC Unprotect	Not Used	Not Used	Not Used	2 DS1/E1s and 1 DS3
Option 6	Not Used	Not Used	QFLC or DS3 FLC Unprotect	Not Used	2 DS1/E1s and 1 DS3
Option 7	Not Used	Not Used	Not Used	Not Used	

(a) If the shelf contains both DS3 in a protected configuration and QFLCs, place the DS3 FLCs to the left of the QFLCs (for FCC EMI compliance.

(b) DS3 FLCs and QFLCs placed in odd- or even-numbered slots should be optically connected to remote FLCs in odd- or even-numbered slots, respectively.

Table 50. *FLC Eight-Position Universal Mounting Shelf*

	Mounting Position Number							
NO.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)
2	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC (a)* or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)
3	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)
4	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)
5	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)	QFLC (a) or DS3 FLC (Unprotect)
6	Not Used	Not Used	QFLC or DS3 FLC (Unprotect)	Not Used	Not Used	QFLC (a) or DS3 FLC (Unprotect)	QFLC or DS3 FLC (Working)	QFLC or DS3 FLC (Protect)
7	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)	DS3 FLC (b) (Unprotect)

(a) In Unprotect Systems, QFLC modules may occupy either or both slots of a slot pair. However, in DS3 FLC Unprotect Systems, a DS3 FLC must occupy only the odd- slot of a slot pair. The associated even slot of the pair must be vacant, unless the Unprotected DS3 Adapter Kit is installed, then a DS3 FLC may occupy either or both slots of a slot pair.

(b) In DS3 FLC Unprotect Systems, DS3 FLC modules may occupy any slot.

Module installation in items number 1 through 6 can be reversed.

In QFLC or DS3 FLC Protect Systems, modules in slots 1, 3, 5, or 7 are paired with QFLC or DS3 FLC modules in slots 2, 4, 6, or 8, respectively.

If an odd- numbered mounting position in the FLC Eight-Position Universal Mounting Shelf is equipped with a DS3 FLC Unprotect System, a Quad FLC Unprotect System cannot be installed in the adjacent (next position to the right) even-numbered mounting position or vice versa.

If the shelf contains both DS3 FLCs and QFLCs, place the DS3 FLCs to the left of the QFLCs for FCC EMI compliance.

QFLCs and DS3 FLCs placed in odd- or even-numbered slots should be optically connected to remote FLCs in odd- or even-numbered slots, respectively.

APPENDIX D - OPTICAL FIBER SYSTEMS CLEANING AND MATING INSTRUCTIONS

Cleanliness affects the performance of an optical fiber system. Perform the following procedures prior to installation. Clean all connectors, adapters, and attenuators before making any connections. The following cleaning materials are recommended and may form part of your cleaning kit:

- Lint-free laboratory wipes
- Cotton tipped swabs
- Isopropyl alcohol in pressurized dispenser
- Lint-free pipe cleaners
- Clean, dry, oil-free compressed air

When using canned compressed air, clear the nozzle with a short air blast before blowing any parts clean. DO NOT SHAKE THE COMPRESSED AIR CAN. Keep the can level while using to prevent liquid in the can from entering the air stream.

9248-A

Handle, use, and dispose of chemicals in accordance with manufacturer's instructions.

CLEANING

Connectors/Terminators

1. Fold a clean, new wipe into a 2" x 2" square pad.
2. Moisten, but do not saturate, the pad with alcohol making a spot approximately $^1/_2$" diameter.
3. Press the ferrule end face into a wet spot on the wipe. Using force, twist the ferrule so that a hard wiping action takes place. Repeat twice, using a clean alcohol-moistened area each time.
4. Press the ferrule end face into a dry spot on the wipe. Using force, twist the ferrule so that a hard wiping action takes place.
5. Discard the used pad.

Attenuators

1. For an exposed ferrule, see "Connectors/Terminators" on page 85 for cleaning procedure.
2. Blow the other end dry with clean compressed air.

Adapters

1. Moisten one end of a lint-free pipe cleaner with alcohol.
2. Remove excess alcohol from the pipe cleaner with a clean wipe.
3. Insert the moistened pipe cleaner into either end of the adapter and rotate so that the inside surface of the adapter is wiped by the pipe cleaner. Repeat this step for the opposite end.
4. Insert the dry end of the pipe cleaner into either end of the adapter to remove any residual alcohol. For oversized adapters (Biconic), slightly bend the pipe cleaner for better surface contact. Repeat this step for the opposite end.
5. Blow the adapter dry with clean compressed air.

MATING

Unkeyed Biconic

1. Grasp the threaded cap of the connector and insert the ferrule into the adapter.
2. Hold the fiber support of the connector to prevent the fiber from rotating.
3. Screw the cap clockwise into the adapter (finger tight only).

Keyed Biconic

1. If there are arrows on the buildout, align them with the arrows on the connector.
2. Grasp the "Boot" support and insert the connector into the buildout.
3. Rotate the connector counterclockwise until the key enters the slot.
4. Engage the threaded cap into the buildout and turn clockwise until the connector is seated.

Subminiature Microwave Amphenol (SMA) Connector, D4, and FC

1. Insert the ferrule tip into the adapter.
2. For D4 and FC types, align the key with the slot in the adapter.
3. Push the connector into the adapter until the nut bottoms against the adapter housing.
4. Screw the coupling nut clockwise onto the adapter to complete the connection.

Straight-Tip Connector (ST®)

1. Align the ferrule hub key with the slot in the adapter.
2. Insert the connector into the adapter until the nut bottoms against the adapter housing.

3 Align the bayonet slots on the coupling nut with the pins on the outside of the adapter.

4 Push the coupling onto the adapter while rotating the coupler nut clockwise to lock the bayonet and secure the connection.

Snap Connector (SC)

1 Align the housing key with the slot in the adapter.

2 Push the connector into the adapter until a click is heard or felt indicating the latching system is engaged. When fully engaged, the white stripes on the sides of the housing should be hidden inside the adapter.

APPENDIX E - CONVERSION TABLE

Table 51 provides a list of measurements with converted metric equivalents used in this guide.

Table 51. *Conversion Table*

Inches (Centimeter Equivalent)	Inches (Centimeter Equivalent)
1.5 (3.8 cm)	12.0 (30.5 cm)
1.8 (4.4 cm)	13.0 (33.0 cm)
2.1 (5.2 cm)	14.5 (36.8 cm)
6.8 (17.3 cm)	15.7 (39.9 cm)
7.5 (19.0 cm)	15.9 (40.4 cm)
8.0 (20.3 cm)	16.7 (42.4 cm)
8.7 (22.1 cm)	16.8 (42.5 cm)
9.6 (24.3 cm)	19.0 (48.3 cm)
11.5 (29.1 cm)	23.0 (58.4 cm)
11.7 (29.7 cm)	

APPENDIX F - PRODUCT SUPPORT

ADC Customer Service Group provides expert pre-sales and post-sales support and training for all its products. Technical support is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center.

Sales Assistance 800.366.3891 extension 73000 (USA and Canada) 952.917.3000 Fax: 952.917.3237	• Quotation Proposals • Ordering and Delivery • General Product Information
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CERTIFICATION AND WARRANTY

FCC CLASS A COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This equipment does not exceed Class A limits for radio emission for digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

This product conforms to all applicable standards of 21 CFR 1040.

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The Product and Software warranty policy and warranty period for all products of ADC Telecommunications, Inc. (hereinafter referred to as ADC) is published in ADC's Warranty Software Handbook. Contact the ADC Technical Assistance Center at 1.800.366.3891, ext. 73223 (in USA or Canada) or 952.917.3223 (outside USA and Canada) for warranty or software information or for a copy of the Warranty/Software Handbook.

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